THE MODEL ENGINEER

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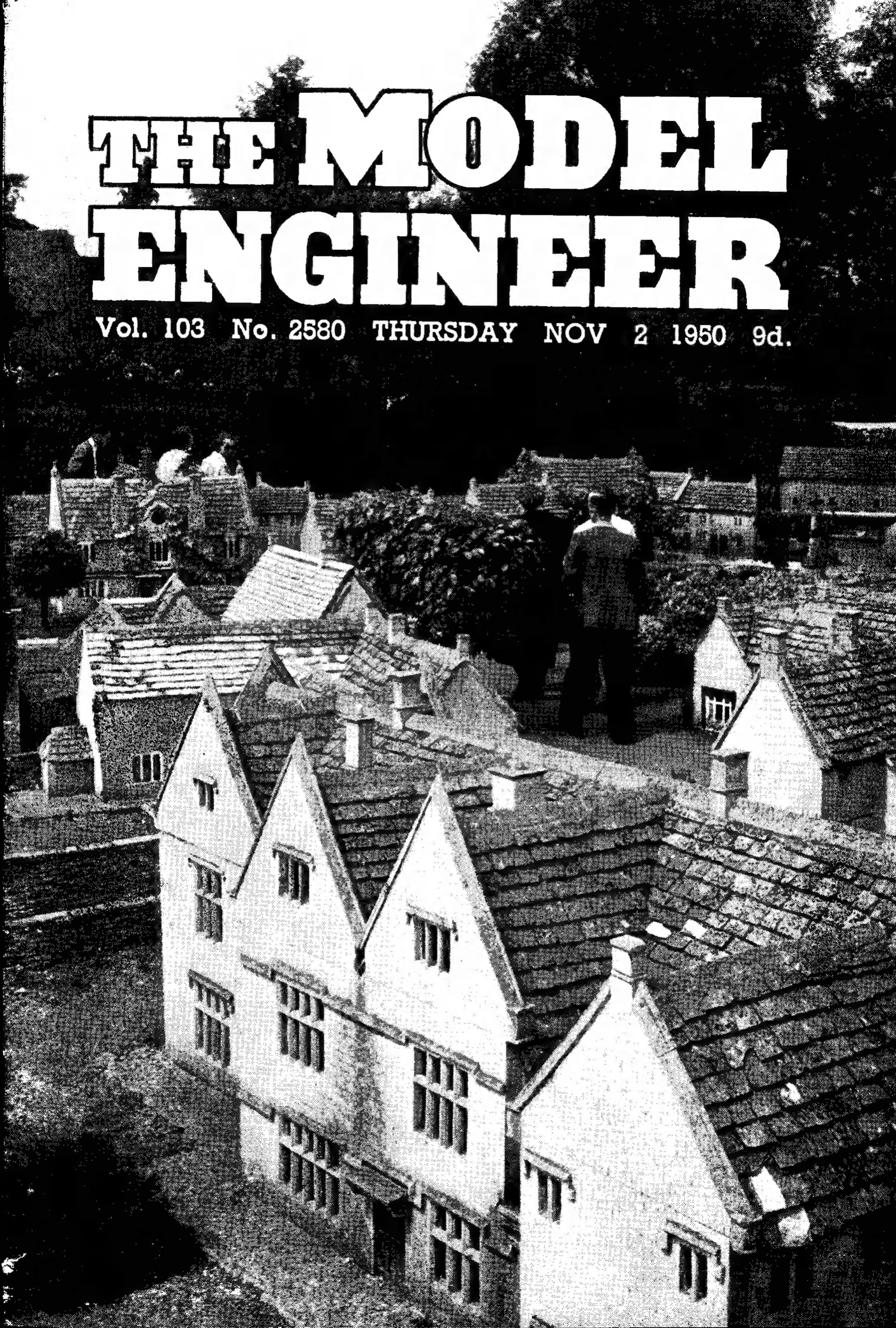


The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD. 23, GREAT QUEEN ST., LONDON, W.C.2

2ND NOVEMBER 1950 VOL. 103 NO. 2580

SMOKE RINGS

Our Cover Picture

● THE SCENE depicted on our cover this week is part of a remarkable model of the village of Bourton-on-the-Water, Gloucestershire. The model is situated in the garden of a house in the main street of its picturesque prototype and is built to one-ninth scale ; it was planned by Mr. C. A. Morris, in 1936, and was constructed by a number of local craftsmen, being opened to the public in 1940. Local charities benefit as a result of its exhibition.

Mr. A. R. Turpin, of Banstead, has visited it and states that on Sundays a church service can be heard in the model church ; actually, the sounds are due to the relaying of the service from the full-size church. Mr. Turpin adds : "When you reach the end of the main street of the model you come, of course, to the model ; and at the end of the main street of that model is . . . well, so on *ad infinitum* ! "

More Forgetfulness

● MR. J. A. KING, hon. secretary of the Welling and District Model Engineering Society has written to thank us for what he refers to as "your kind remarks about the Welling Society" in the issue for October 12th, when describing the S.E. Association regatta. He goes on : "I would add that we gathered a third prize in the shape of a raincoat. This was found when clearing up after the regatta, and I took it into safe custody. Enquiries have not traced the owner ; do you think you can find space to give this publicity ? "

We are pleased to do so and to add that if this note catches the eye of the owner, he can recover his raincoat by writing to Mr. King at his home, 150, Sutherland Avenue, Welling, Kent.

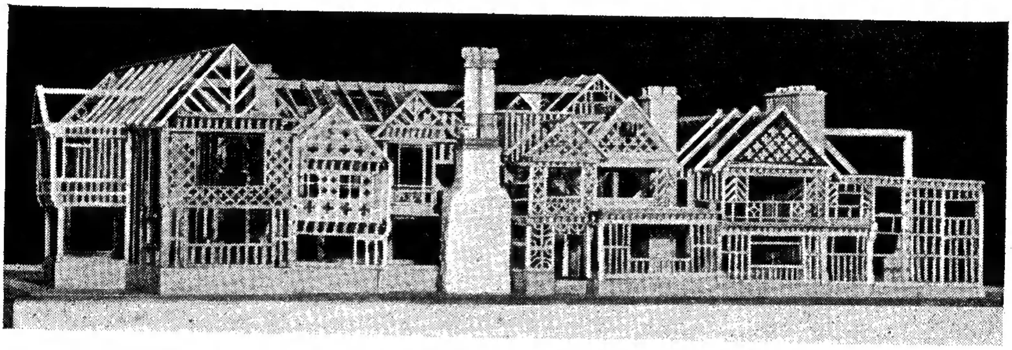
An Invitation to Worksop Readers

● MR. P. ROSSINGTON, of Worksop, has written to say that, thanks to the "M.E.", he has recently completed a "Juliet" which is a great success. He enclosed a photograph of it, and we can confirm that the little engine is nicely finished and looks the part in every way. Mr. Rossington writes : "She steams very well, and has so far hauled a maximum load of just over 3 cwt., which is all I could get on the available rolling stock. She is, of course, a first attempt. If any local model engineers would like to have a run on my track, which is 150 ft. of nearly straight up-and-down, they are very welcome. I say this because the nearest running facilities to us are, I believe, in Sheffield."

This is a generous invitation which we are pleased to pass on to all whom it may concern. The address is : c/o G. W. Rossington & Son, Central Avenue, Worksop. Our friend concludes with cordial thanks "for your excellent articles and most interesting paper," to which we reciprocate with our best wishes to him for all success in future locomotives.

A Remarkable Framework

● STRUCTURES OF most kinds are usually built on or around a frame which, of course, has to be substantial in order to ensure durability. In small-scale reproductions of structures, the same should apply, though often it does not! However, many of us have seen and admired Mr. G. Clasby's models of old houses and buildings, but few of us have realised that these very attractive and picturesque models are made as nearly as possible in the same way as the prototypes.



At the recent exhibition of the Brighton and District Society of Model and Experimental Engineers, Mr. Clasby exhibited a selection of his work, including a really spectacular new one. By courtesy of the Sussex Photo Agency, we are able to reproduce a photograph of this extraordinary piece of work which, as will be seen, is the timbering that is required for a miniature reproduction of an elaborate Tudor mansion. The prototype is Bramhall Hall, Cheshire, and the model is being built to a scale of 1/72 to plans kindly loaned by the Bramhall and Hazelgrove Council. The photograph shows clearly that an enormous amount of timber was required in a building of this kind, and Mr. Clasby has certainly gone to a great deal of trouble to reproduce most of it. He informs us that the only timbers which he will omit are the floors, as they will interfere with the lighting and cast shadows across the windows. Such an omission is, we think, excusable in the circumstances and is hardly likely to affect the stability of structure. We can well imagine that this model, when completed, will be most effective.

Progress at Keighley

● WE HAVE just heard again from Mr. Harland Brownless, chairman of the Keighley and District Model Engineering Society, and we are pleased to note that this society seems to be firmly established and is becoming quite a potent amenity in the district. There are at least eight coal-fired locomotives under construction.

Mr. Brownless adds that the marine interest is very well represented, and some of the members in the aircraft section are hoping to be well placed in flying competitions next year. Already, the society has been promised representation in next year's Festival of Britain activities, and will probably organise an exhibition during that period.

It is clear that things have gone very well, so far, and we hope that the good progress will be maintained. But the society, we know, has a very keen enthusiast and an inspiring leader in its chairman.

We wish all success to their efforts.

The World's Biggest Window

● A SHEET of polished plate glass, $\frac{3}{8}$ in. thick, 50 ft. long and 8 ft. high, weighing more than 1 ton, has been made for the Festival of Britain South Bank Exhibition. This colossal "window" was manufactured by Messrs. Pilkington, Cowley Hill, St. Helen's, Lancs, whose 1,000-ft. twin-grinding and polishing plant was the first in the world for producing glass in a continuous ribbon from raw materials to the finished state.

Not the least problem to be solved in connection with the "window" was its transport from St. Helen's to London, a distance of 200 miles. The moving load had a length of 65 ft. and a height of 13 ft. 6 in., the trip being made by road over a route which had to be very carefully surveyed beforehand. The maximum permissible speed was 8 m.p.h. and the time was about five days. To lift this enormous sheet of glass into and out of its case, a special vacuum-operated "sucking" machine is used and, of course, after lifting the glass into the case, had to travel with it to perform the reverse operation at the journey's end.

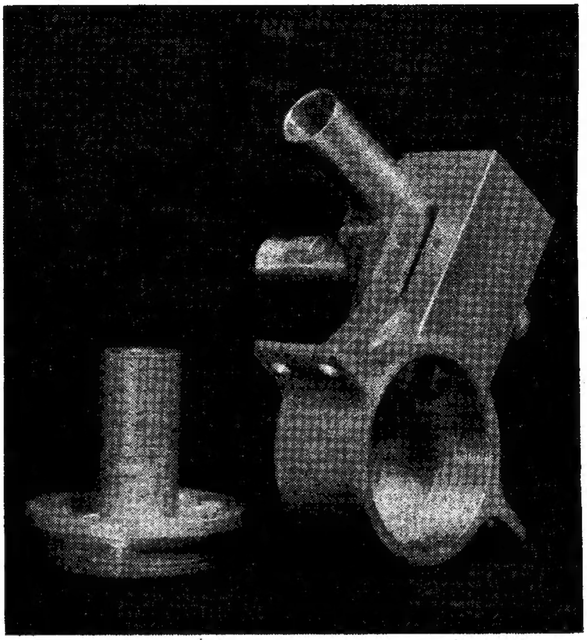
Tom Greenwood

● WE REGRET to learn that the City of Bradford Society of Model and Experimental Engineers has suffered a severe loss by the passing of Mr. Tom Greenwood who had been an active member of the society since 1938, and had served on the committee for the last five years. He was a prolific maker of models, including mill engines, petrol engines, electric motors and different kinds of household appliances in miniature. But it was, perhaps, his electric clocks that made him widely known. They were of various shapes and designs, each one a masterpiece and every part made by himself, out of all kinds of scrap material. He always seemed to be best pleased when he could say, as so often he did, "It cost me nowt." Our hobby is the poorer for his passing; but the society he served so well will miss his ever-friendly presence at meetings and other functions. Memory of him and all that he stood for will linger for many years, and will serve to inspire those who follow after him in his influence.

*Building a 1.9 c.c. Diesel

by G. D. Schepel and J. Buwalda (Holland)

THE piston is made of cast-iron. Silver-steel is longer wearing, but it is only usable when the cylinder material is harder than material of the piston. If the cylinder is chrome-plated and highly polished we can use an unshrinkable steel and harden the piston. Do not make it too hard! We see on the drawing that the bearings for the wrist-pin are made of two steel tubes which are fitted tightly and brazed into the piston. There is no objection against brazing before hardening. Before doing this the outer diameter of the piston must be about $\frac{8}{16}$ in. After brazing we can ream the wrist pin holes, then we carefully turn the piston down to the accurate diameter and polish it very highly so that it fits *perfectly*, without side play into the cylinder! This is one of the most important points of this motor, because without high compression it will not run.



The crankcase and cover of the small diesel engine

For making the *wristpin* we can use a piece of silver-steel of 5/32 in. diameter. Wristpin pads on both ends are made of brass or aluminium.

The connecting-rod is made of al. alloy or electron. Before filing the rod to the correct profile, both holes are to be drilled at right-angles to the rod and parallel with each other. When this is done, the bronze bearings can be pressed in.

The crankcase cover also serves as a crankshaft bearing. A casting can be made or it can be made out of a full piece of material, but then without the three weight reducing cavities. In this case it does not look as well. It is made of al. alloy. The hole and flange can be made in one operation by holding the straight end in the chuck. The hole must be exactly at right-angles to the flange. The crankshaft bearing is made of bronze and is pressed tightly into the cover. The hole can be reamed after that. The crankshaft must run very easily without side-play.

The driving disc is also made of an al. alloy. The tapered hole is made with the special drill, described in the section about the crankshaft (see Fig. 8). Take care that the disc does not wobble! When it is pressed on to the shaft, the end-play must be 0.008 in. at least.

The cylinder-head is made of steel, with or without variable compression control. We made both and with variable compression the head was not leakproof and after some time the compression ratio dropped. So we made a head with constant compression which is determined experimentally. Too low a ratio will cause trouble, so will an excessively high ratio. The distance between cylinder-head and piston in highest position is about 1/64 in. It is important to make the underside of the head with the same taper as the top of the piston, which must have a smooth surface.

We illustrate both solutions and you can choose. By using the variable one, the compression piston must be made with great care and polished very highly. The finish must be similar to that of the piston, but contrary to the piston it must fit tightly in the head. It is made of silver-steel. It is advisable to ream the hole in the head.

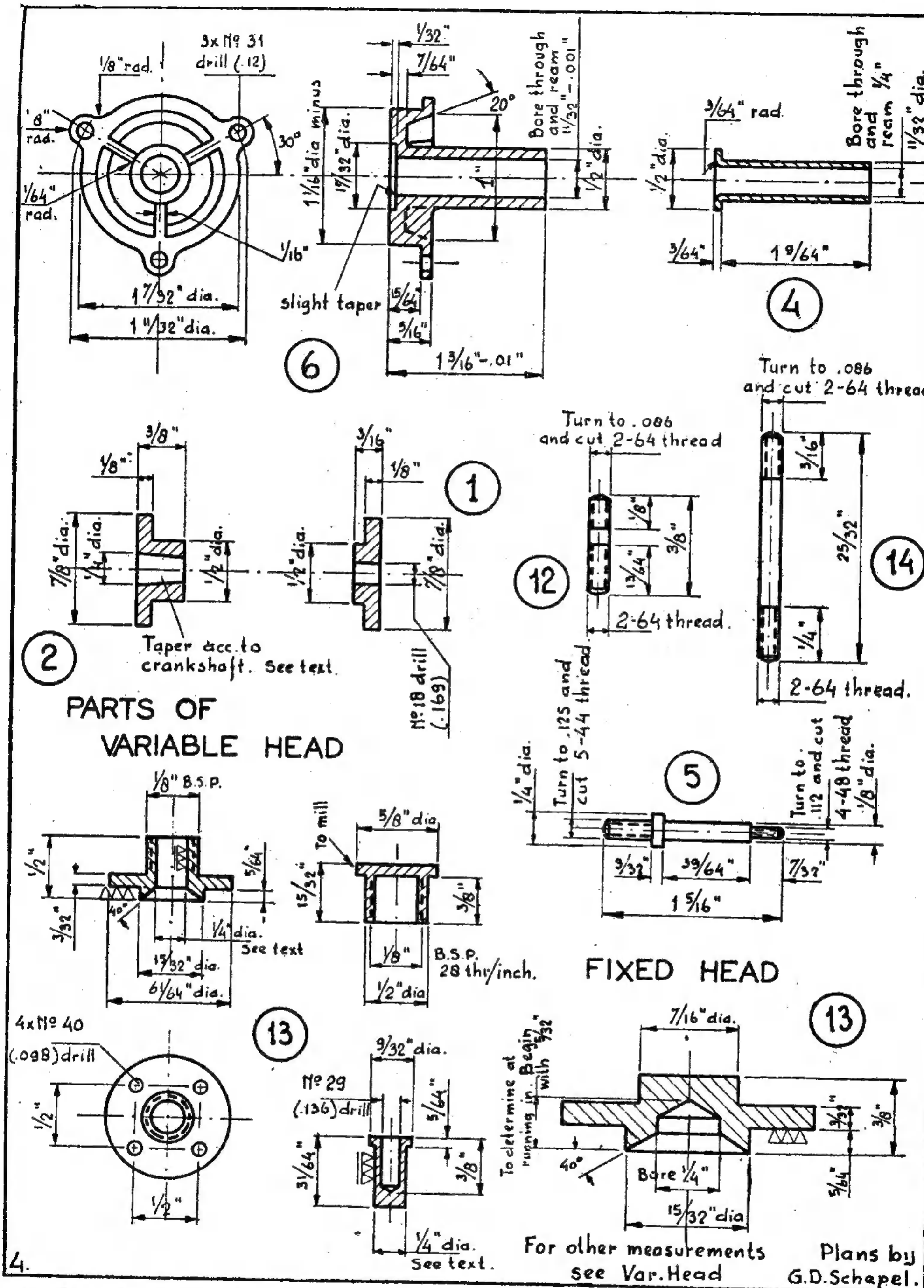
The studs for attaching the cylinder-head and bypass-covers can best be made of steel cycle spokes. These are tough and fairly hard, but it is easy to cut a thread with a die nut.

Carburettor

This consists of several parts, as: fuel-tank, body, needle-valve with screw for micro adjustment, plug-tap and fuel-tube.

As this motor has no electrical ignition we stop the motor by interruption of the fuel injection. For this purpose a plug-tap is used. This plug can be controlled by a rod connected to a timer. Several parts of an old petrol motor can be used, but we also give a drawing of the parts. After reading the description of the motor

*Continued from page 637, " M.E.," October 26, 1950.



parts, the carburettor will offer no difficulties. For our first motor we made all parts for the carburettor of brass, except the needle-valve which is made of steel piano wire. By using an al. alloy we can reduce the weight, which is important when we wish to install the motor in an aeroplane. After having cut the plugtap, we make another cannon drill for drilling the tapered hole in the body. The needle-valve must fit accurately into this.

Assembly

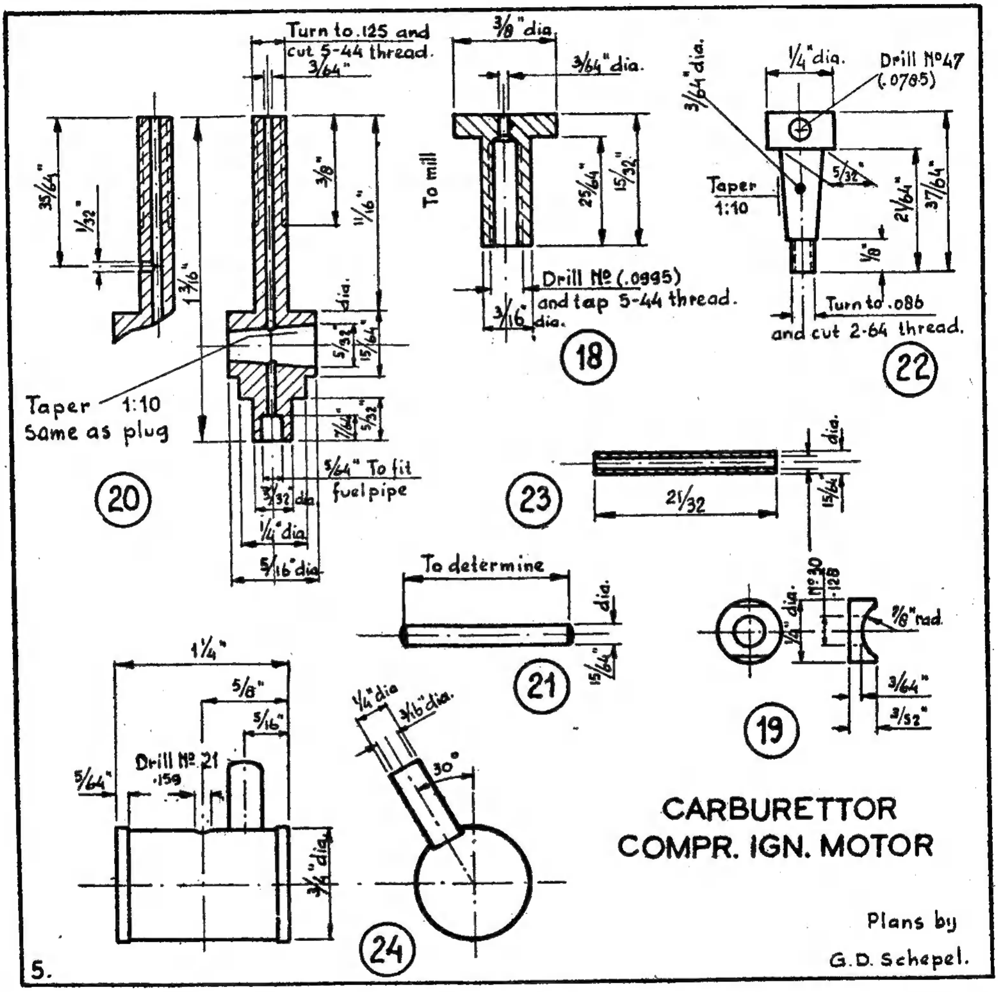
When all parts are ready they must be cleaned carefully. Also clean your hands! A little oil is added when assembling the parts. First the intake tube is mounted then the cylinder is pressed into the crankcase. Before mounting the cylinder-head, the assembled piston with connecting-rod is brought into place. We mount the crankcase cover in whch the crank-shaft has been previously placed. The various nuts must not be tightened too hard; the best thing is to use a small wrench.

Now we can assemble the carburettor. The needle-valve is not yet soldered to the nut. We go to work as follows :—

We mount the body of the carburettor to the intake tube with carburettor jet away from the motor. Looking through the intake tube we can see the needle valve. When the nut is turned clock-wise the opening must be shut by the needle-valve. We can check this by blowing through the fuel tank. If the correct position has been determined we solder the needle-valve to the nut. Take care that the needle-valve is free of oil, because piano wire is difficult to solder. The underside must not have any burrs! When this is ready, we take the carburettor to pieces and turn the body 180 deg. so that the jet opening is turned towards the motor.

In most cases the motor, at first, will be too stiff to operate under its own power. We will have to drive it. This we can do on a lathe We take off the driving disc and mount the crankshaft end in the universal jaw or collet-chuck. Running-in is done without carburettor and without cylinder-head. When the flywheel has already been made we can mount this in the chuck. We use much oil with a little polishing paste.

Before the motor operates by its own power, it is disassembled and cleaned. Now it is again assembled completely with liquid seal on the flange of crankcase cover, bypass covers and between crankcase-cylinder-cylinder-head. For



sealing we use liquid seal, as this is the only usable kind, but the parts must be exactly flat.

Fuel. The fuel we used is an ether-petroleum oil and castor oil mixture with a proportion of 45 per cent. of the first, 45 per cent. of the second and 10 per cent. castor-oil. The mixture is relatively critical and since you have no ignition

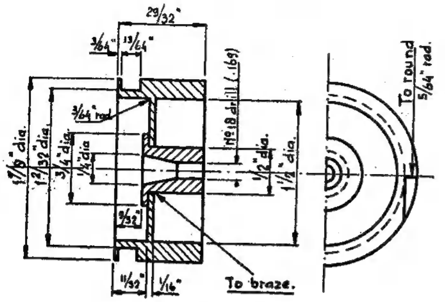


Fig. 10

problem you can afford to spend a little more time getting the mixture right. When buying oil, to use as an ingredient in this diesel fuel, be sure that it is wax free. The wax in the oil causes the formation of a crust on the top of the piston and this changes the compression ratio of the motor. When we have our fuel we are ready to start the engine.

For the benefit of those who have never worked with a diesel engine before, some remarks: use a flywheel for the first time; the motor will start more easily. Squirt a few drops of fuel to the exhaust port and open the needle-valve ¼ turn. If you have made a motor with variable compression, enlarge the chamber by turning the compression screw; a few sharp flips of the finger against the propeller and the motor will run. Using no squirting in the exhaust port you must choke two turns, and on the third turn the motor should start. If it fails to run, it is possible that too much fuel is in the cylinder. In this case turn the propeller, or flywheel, a few times by hand and hold the motor on the slant in order to blow out the excess fuel. It is possible that the fuel will ignite while doing this; in this case, close the needle-valve.

If the motor starts, in most cases the compression will be too high. You will hear a knocking sound which is a sign that the compression chamber should be enlarged. When it gives short fast spurts of power the mixture is too rich and the needle-valve should be closed. The position of the needle-valve must be determined experimentally.

We recommend that you mount a 9 in. diam. propeller with 9 in. pitch on this motor for flying a model up to 4 ft. and with a total weight of 15 oz.

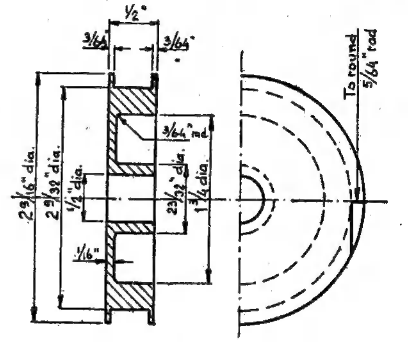


Fig. 11

A flywheel is shown in Fig. 10 which we mounted on this motor when it was installed in a boat.

When used as a stationary engine, fit the fly-wheel as shown in Fig. 11.

Good luck!

The Lone Hand

There are various reasons why some model engineers continue to work as lone hands. In some cases the reason is geographical—there is no club or society within reasonable distance, and the model maker has to depend on his own resources. In this case he should keep his eyes and ears open for any hints as to the hobbies of his associates. It is very surprising how the most unlikely people seem to share our hobby and once he has contacted such a person it is not long before he finds others and a new society is born. Most of our societies came about in this way and there is no reason why every small town should not have its own. In other cases the model maker prefers to work alone—perhaps because he is naturally shy and of a retiring disposition and prefers not to let others see his work, especially in an incomplete condition. Another, again, usually possessed of greater ability and experience, considers he has nothing to gain by associating with other modellers and that time spent at a club meeting is just so much time lost for model-making. In this he is mistaken, as it is quite possible his club will include another modeller of equal ability to himself from whom, owing to the fact that no two craftsmen work in exactly the same way, he could certainly learn something. Then again, time spent in contemplating other people's models or even only in exchanging views with other modellers, is never time lost; it always enables one to see one's own efforts in a truer perspective. The shy modeller has everything to gain by joining a society. The candid comments of his fellow members on any work he may be doing may be rather frightening at first, but he will soon realise that they are usually made with a view to helping him, and once he understands that, he will get untold benefit from them. He should also remember that, being shy doesn't mean that his work is necessarily inferior to that of his critics. If he knows it is good and doesn't apologise for it he will soon find that good work always commands respect from other craftsmen, and when this happens he is well on the way to overcoming his shyness and improving his personality generally.

Novices' Corner

Abrasive Stones and Wheels

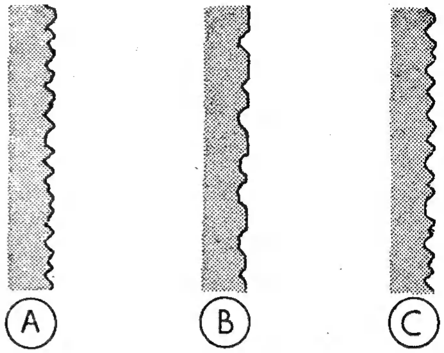


Fig. 1. Diagrammatic magnified view of a grinding wheel: "A"—a normal wheel; "B"—a worn wheel; "C"—after dressing with a star-wheel

ABRASIVE materials are commonly used in the workshop for sharpening tools, and at times for imparting a smooth finish to machined surfaces.

In the past, natural stones were employed for giving tools a keen cutting edge; for example, the grindstone, the whetstone, and the oilstone. Later, however, artificial stones were produced which for many purposes gave superior results.

The best known natural abrasive stone is, perhaps, the Arkansas stone, which, after being quarried, is formed into shapes suitable for use in the workshop. The hard variety of Arkansas stone, varying in colour from almost white to nearly black, has the finest grit of any oilstone and is unequalled for giving cutting tools the best-finished and sharpest edge.

The hardness of the stone ensures that it is not readily worn unevenly even with prolonged use, nor is it liable to become scored when sharpening pointed tools such as scribers. There are some softer kinds of Arkansas stones, but, although these cut rather more quickly, they do not produce so fine an edge on the tool.

When buying a bench oilstone, it is advisable to select one of full size, that is to say a stone 8 in. long, 2 in. wide, and 1 in. thick; a stone of this size is then suitable for all ordinary use in the workshop, including the sharpening of wood chisels and plane irons. In addition to the bench stone, these stones are made in many varieties of shapes and sizes, such as small hand slips for touching up the edges of lathe tools, and curved stones for sharpening gouges and form tools.

The familiar Washita stone, much used by carpenters, is of softer texture, and is, therefore, more easily scored or worn unevenly; nevertheless, these stones cut quickly and produce a good cutting edge. The fact that the cost of these stones is only about a fifth of that of an equivalent Arkansas stone may, in part, account for their selection by many workers.

When using either type of oilstone, it is essential that the surface should be kept well supplied with thin oil, and, after use, the stone should be wiped clean to remove the dirty oil together with any adhering metal particles.

Artificial Abrasives

Abrasives are manufactured by fusing natural mineral materials in an electric furnace, thereby forming substances but little inferior to the diamond in hardness. After fusion, the resulting material is crushed, and the powder so formed is graded mechanically into grains of uniform size. Next, this abrasive powder, together with a suitable bonding material or matrix, is moulded into various commercial shapes and then finally baked at an intense heat. Two main varieties of abrasive substances are produced in this way: silicon carbide and aluminium oxide. The Norton Company, who were pioneers in this field, have named the silicon material—Crystolon, and the aluminium compound—Alundum. Alundum is used for the manufacture of the well-known India oilstones which are obtainable in a

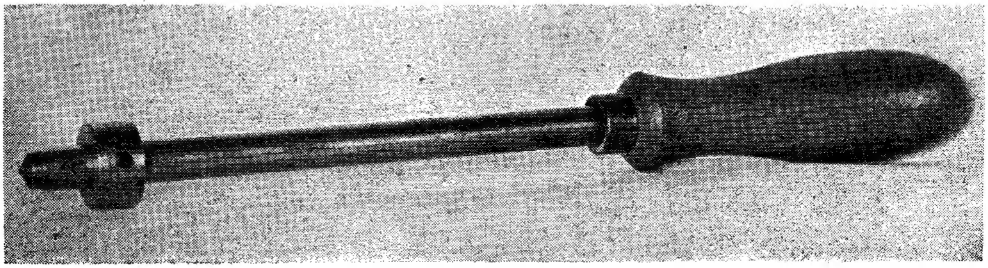


Fig. 2. A diamond-tipped dresser

variety of sizes and shapes, and in three grades, namely : coarse, medium and fine.

These India stones, which are extremely hard and fast-cutting, are not easily scored, but Crystolon stones, although they cut rapidly with only light pressure, are more readily worn and rendered uneven with much use. Both types of stones are impregnated with oil at the time of manufacture ; nevertheless, when in use, stones should be liberally supplied with oil in order to float off the metal particles formed and prevent their adhering to the surface of the stone. After use, the stone should be cleaned and then put away in its covered box.

Artificial stones, like the Arkansas and other natural stones, are made in a great variety of shapes and sizes suitable for all workshop purposes.

Abrasive Paper and Cloth

For finishing woodwork, flint or glass paper is commonly used, but powdered garnet, a natural abrasive, is now extensively employed, as it has proved superior for this purpose. Moreover, the natural product, emery, has been largely displaced by artificial abrasives, such as aluminium oxide, in the manufacture of papers and cloths used for finishing metal surfaces.

Woven tape, an inch or so in breadth, is manufactured covered with a layer of artificial abrasive ; a roll of this material will be found most useful for many small polishing operations in the workshop.

Grinding Wheels

For fine work, such as sharpening the smallest sizes of lathe boring tools, the small India grinding wheels answer well, as owing to their hardness and fineness of texture the danger of removing metal too quickly and spoiling the tool is greatly reduced ; moreover, the oil with which the wheel is normally supplied will help to prevent overheating of the tool.

Ordinary tool grinding in the small workshop is usually carried out by employing either a silicon carbide or an aluminium oxide wheel used in the dry state. The composition of any particular grinding wheel is shown by an inscription stamped on the wheel itself ; thus, 60 is the grain size of the abrasive material ; M—denotes that the bonding material is of medium softness and can readily be worn away to allow fresh, sharp grains to be exposed ; the final symbols indicate the composition of the bonding material, whether for example it is vitreous or glass-like, or resinous and elastic. Further information on this subject will be found in manufacturers' catalogues, but the tool merchant will supply a suitable grinding wheel if the purpose for which it is to be used is specified.

Care of Grinding Wheels

Needless to say, if a grinding wheel is to give satisfactory service it must be correctly mounted and properly cared for. Grinding-wheel manufacturers state that the inner flange of the grinding spindle must be securely fixed to the spindle itself, and that it should be machined to run truly after being pressed into place on the shaft. The wheel should always run truly, and at the speed advised by the makers ; soft material such as aluminium and soft steel should not be ground on a wheel made for grinding hardened steel tools.

After considerable use, it may be found that the wheel has, in part, lost its original cutting qualities and tends to heat and polish the surfaces of the tool rather than abrade them.

This may be due to the wheel becoming what is termed "glazed," that is to say, the sharp cutting points of the individual abrasive grains are worn smooth, and these worn grains have been retained by the bonding material instead of being shed, as they should, and thus exposing fresh grains. This can often be remedied by running the wheel more slowly and at the same time pressing the tool more firmly against the wheel, or it may be that a softer and less tenacious grade of bonding material is required to hasten removal of the worn grains. A grinding wheel is said to be loaded when its surface is clogged by adhering metal particles ; this condition of the wheel will cause rapid heating of the work with very little abrasive action. Increasing the speed of the wheel and using less grinding pressure will help to prevent this loading. A wheel intended for tool grinding may quickly become loaded if used to grind soft metals.

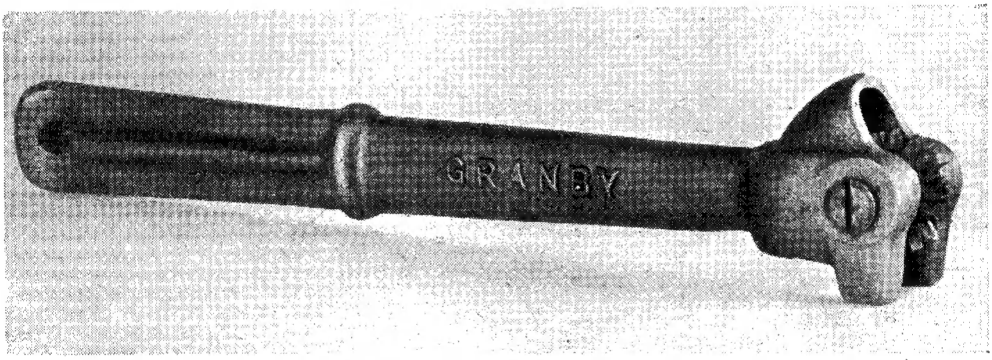


Fig. 3. A star-wheel dresser

When a wheel has become glazed or loaded, it can be restored by dressing its surface with either a diamond tool or a disc dresser.

Fig. 1A shows purely in diagrammatic form the highly magnified appearance of a new wheel; and it will be seen that the abrasive grains are represented as protruding from the surface in the form of a series of jagged points. When the wheel has become worn and glazed, as in Fig. 1B, the abrasive particles have flat, smooth surfaces which are no longer capable of normal cutting.

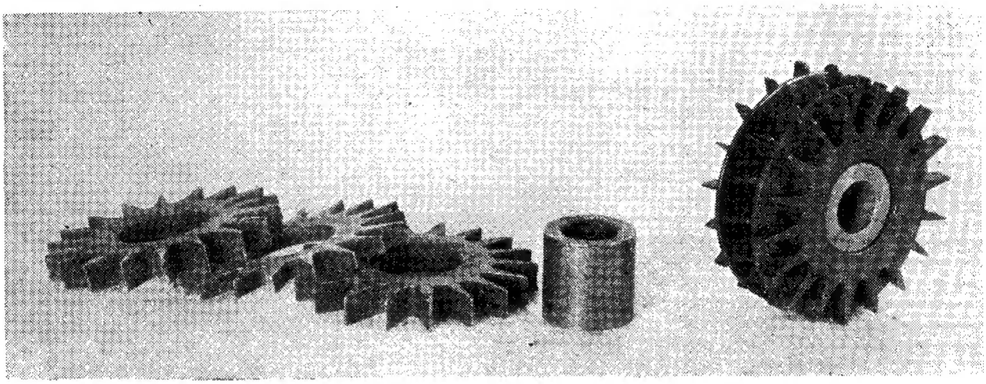


Fig. 4. Left—Parts of a star-tooth wheel; Right—A shrouded star-tooth wheel

This appearance, too, will result to some extent when a diamond tool is used to true the surface of the wheel, for the diamond, being the harder, will cut and flatten some of the fresh grains in the process of removing the worn grains. In commercial practice, grinding machines are equipped with a self-contained diamond tool, which from time to time is brought into contact with the wheel to restore its truth. A diamond hand tool used for truing and dressing wheels is shown in Fig. 2, and it will be seen that an adjustable guide collar is fitted to the shank to act as a guide when applied to the edge of the grinding rest.

The star-tooth wheel dresser, Fig. 3, is used for breaking up the surface of a worn or loaded wheel and thus exposing fresh, sharp cutting grains, as represented in Fig. 1C; this form of dresser can also be employed for truing the wheel, as it is capable of removing the actual material of which the wheel is made. The two types of star wheels used for dressing are illustrated in Fig. 4; that on the left is coarse cutting, and can be used on a grinding wheel in bad condition; the shrouded wheel on the right cuts less deeply and so will give a better finish to the wheel surface. The forked holder in which the wheels are mounted should be long enough to afford sufficient leverage for controlling the tool when in use.

When dressing wheels in this way, care must be taken to carry the cut as near as possible up to the wheel flanges, otherwise a ridge will be formed, which will interfere with the grinding of tools on the side faces of the wheel.

Cut-off Wheels

A form of wheel, not so far mentioned, is the cut-off wheel which, as its name implies, is employed for cutting various materials including steel, plastics, and ceramics.

These wheels are made from 1 in. to 20 in. in diameter and from 1/32 in., or less, to 1/8 in. in thickness; the bonding material is flexible and usually consists of shellac, resinoid substances, or rubber. The Universal Grinding Wheel Co., who manufacture these wheels, recommend that the feed should be at the rate of 3 sec. per inch of the cross sectional area of the material; that is to say, a 2 in. diameter metal bar would normally be cut through in 10 sec. These figures, of course, apply only where the cut-off wheel is used in a heavy, rigid machine, specially designed for the purpose, and equipped with a screw-fed work slide.

In the small workshop, however, where hand-feeding is employed, the use of a cut-off wheel is restricted to cutting small pieces of hardened material which cannot be cut with a hacksaw; for example, hacksaw blades and lengths of parting tool material can be cut through quite readily in this way, but at the same time care must be taken to feed the work evenly and not crowd it against the wheel.

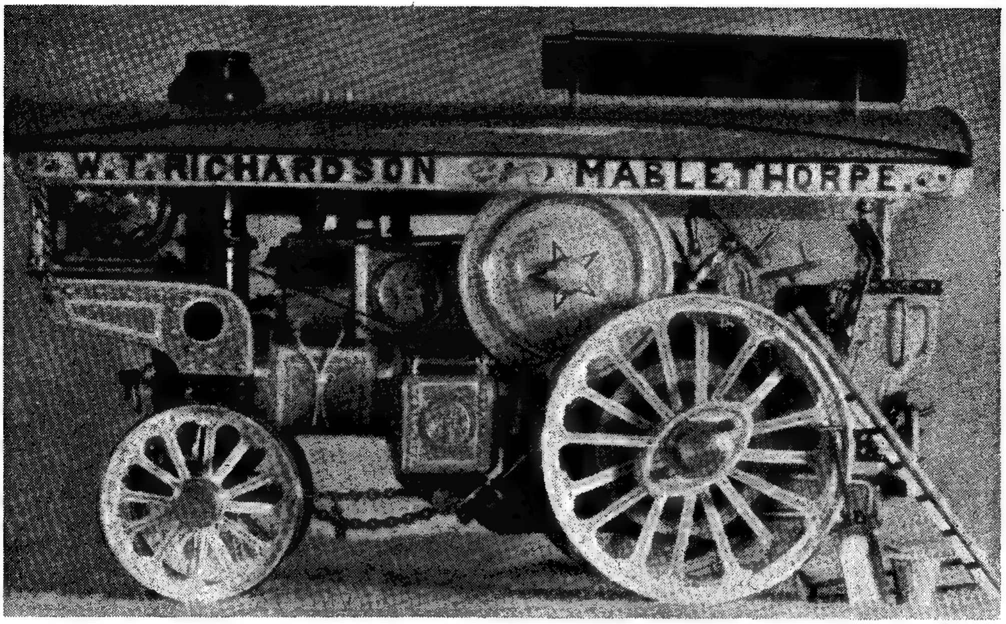
For the Bookshelf

Modern Railways, by Brian Reed. (London: Temple Press Ltd.). 104 pages, size 7 in. by 10 in. Fully illustrated. Coloured frontispiece. Price 8s. 6d. net.

This is the latest addition to a series of popular books for boys, and deals very fully, though simply, with the purposes, planning, building, organisation, operation, control and signalling of modern railways. The text is well printed and is written in a light, easy style that can be readily understood. The book should make an admirable gift for a railway-minded boy.

A Showcase Road Locomotive

by W. T. Richardson



FOR some time, I have had many plates and parts ready for my 4-in. Burrell, and prepared quite a number of components.

However, owing to pressure of other work after saying goodbye to Derbyshire, and later, following another removal, I have so far not had the facilities for re-erecting [redacted] suitable workshop, so that all thoughts of the “Burrell” had to be curtailed.

The urge to build was not [redacted] easily damped, however, and after studying the article on “Road Locomotives” by Mr. P. W. Bradley, in THE MODEL ENGINEER, August 29th, 1946, I took [redacted] fancy to the outline of the “Fowler” engine shown in the drawing. I redrew it to ¾-in. scale to provide me with a full-size diagram, this being the maximum I felt I could tackle, even for [redacted] non-steaming model, with the crude and limited tools and material I now possessed.

So, in [redacted] corner of a chicken house, my only workshop, with [redacted] soldering-iron heating over [redacted] “Buflam” wick stove, [redacted] start [redacted] made to shape the boiler and firebox from [redacted] old brass tube.

As I [redacted] unable to procure materials, I was constantly stumped, but by numerous raids upon dust bins, etc., little by little the junk took the shape of [redacted] engine.

Some parts were turned upon my dismantled lathe, [redacted] rusty outside. These were made by turning the chuck with my left hand, whilst others were done with a hand brace gripped in the vice.

The canopy was made from a cut-up sheet-iron tank, too rusty, I found, to solder except with great difficulty. I do not ever want to try another with similar material.

However, the engine began to have such a nice outline, in spite of much rust upon some parts, that I was spurred on, and after approximately two years, I had the satisfaction of seeing it finished in detail and painted.

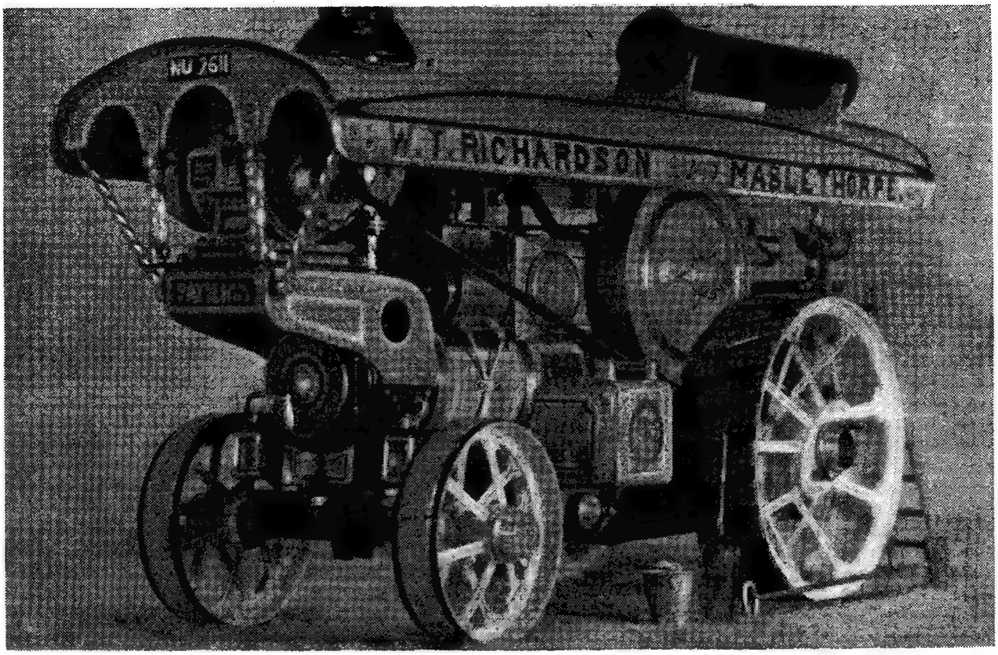
The flywheel revolves in the bearings and drives the generator pulley, designed to be driven later by a concealed electric motor. All the brasswork is easily detachable for cleaning purposes.

The painting was quite [redacted] task, but like all others, eventually completed. The colour is signal red with yellow lining, while the wheels are yellow with red lining.

This combination, together with all the polished brasswork, really does look very realistic. So much so that I have now spent 251 hours on [redacted] caravan of the same scale, now three-parts finished, to go with it.

The latter depicts the type of caravan found in that era when they were embellished with lavish ornamentation, and accompanied the many engines, organs and shows.

The photographs reproduced herewith, were taken by Mr. F. J. Soar, Mablethorpe, who showed great patience and skill in order to obtain the best views possible.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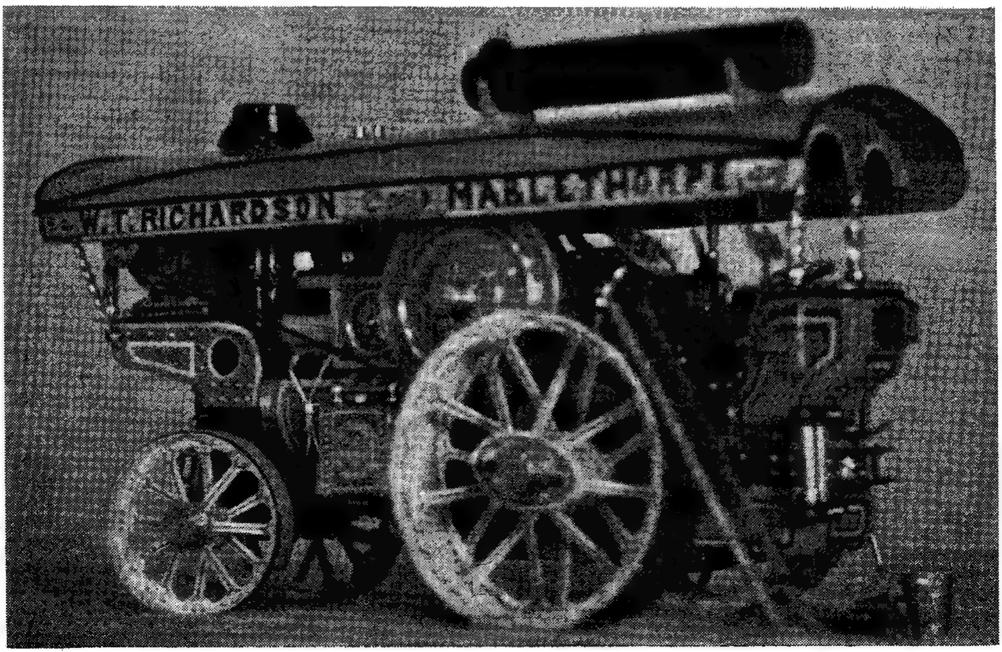
MABLETHORPE


W. T. RICHARDSON
MABLETHORPE

"Pamela's" Regulator

by "L.B.S.C."

The full-sized "spam cans" [redacted] provided with regulators which many drivers call the "all-or-nothing" type, though officially it is of the double-beat pattern, and is nearly [redacted] century old. It was first used [redacted] the old London and North-Western Railway in the late 1850s, when Mr. Ramsbottom specified it for the *Lady of the Lake* single-wheelers. The valve itself is in the shape of [redacted] spool, or cotton reel, seatings being formed [redacted] the flanges at both ends. The upper flange is a little bigger than the bottom one, otherwise the valve could not be fitted to the regulator head. This has two circular seatings in it, one above the other, spaced so that when the valve is dropped in place, both flanges rest on their seatings at the same time, each one fitting steamtight. At least, they are supposed to fit steamtight; but in actual practice, if the top one is tight, the bottom one leaks, and vice versa. No matter how carefully the valves are ground to their seatings in the shops, it is next to impossible to get the valve and the head to expand exactly the same; and it only wants [redacted] weeny bit of difference in the expansion between valves and seatings, to cause one of them to leak.

The main advantage claimed for these valves, is that they give a large area of port opening for [redacted] very small amount of valve movement. They certainly do all that, and it is the very reason they collected the nickname mentioned above. The inability of the driver to allow just [redacted] little steam to pass, when he opens the regulator, is the cause of the "spam cans"—and engines on other railways—performing [redacted] dervish dance and trying to knock themselves to pieces.

An all-or-nothing regulator—it would be more correct to call it [redacted] throttle valve, as it doesn't do much in the regulating line!—is one of the things we decidedly *don't* want [redacted] *Pamela*; so I have substituted [redacted] simple slide-valve regulator, operated by [redacted] push-and-pull handle. A single handle is used, in the middle of the backhead; whilst it would be easy enough to fit a cross shaft, with [redacted] handle at each end, [redacted] on the full-sized engines, the cross-shaft would foul the footplate fittings, [redacted] ours have to be proportionately larger than in full-size. Also, when driving from a car behind the tender, instead of being on the footplate, the central handle will be found [redacted] convenient.

How to Make the Valve Body

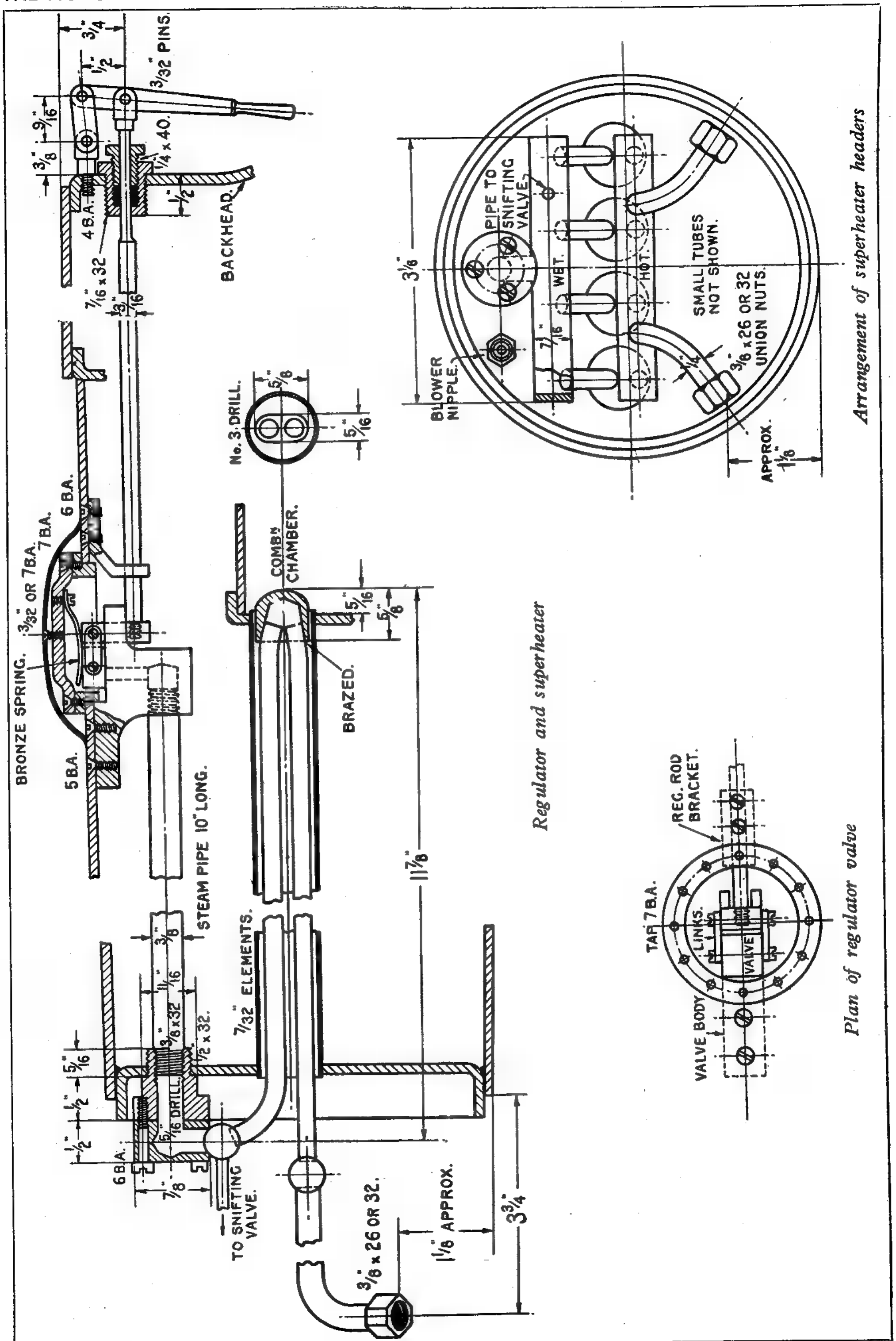
Our approved advertisers will probably supply [redacted] casting for the valve body, and if so, it will only need cleaning up with a file, drilling the steamways, truing the port face, and tapping for the steam pipe. These operations are just the [redacted] on [redacted] body cut from [redacted] solid block of bronze or gunmetal. For the latter, [redacted] block 2⅛ in. long, 1⅛ in. deep, and ½ in. thick, would be required; and it is a simple enough job to saw it to the shape shown, although requiring [redacted] certain amount of elbow exercise. Except [redacted] the port face, there is no need for [redacted] posh finish; personally, I'd never bother about spit-and-polish for a gadget that spends its working life hidden away from human ken, when the working of the engine isn't affected. Life's too short! Mark off [redacted] the front end, the location of the steam-pipe hole; drill it 11/32 in. for ⅝ in. depth, and tap ⅜ in. × 40. Now mark off the two vertical holes at 7/32 in. behind the step, and drill with 11/64-in. drill, as close together as possible, until they break into the horizontal hole underneath. Chip a little triangle at the front end, with a chisel made from a bit of ¼-in. silver-steel; this allows [redacted] very fine steam regulation when starting away, and slipping [redacted] be eliminated by any driver who has the average amount of brains in his noddle, and [redacted] them.

The ¼-in. slot which guides the actuating arm, should be machined with [redacted] ¼-in. end-mill [redacted] slot-drill in the three-jaw, the block being clamped on its side under the slide-rest toolholder, and set at lathe centre-height. Regular followers of these notes should be able to do [redacted] job like that with their eyes shut; I've described similar processes often enough, goodness only knows! It can also be cut in a regular milling-machine. File a cross-nick, or undercut, at the end of the step, before starting to get a true face on it; see drawing. If you don't, you'll probably get [redacted] weeny ridge right at the end, which will lift the valve [redacted] shade, and prevent it closing steamtight. If the block is rubbed carefully on [redacted] big flat smooth file, laid on the bench, there should be no difficulty in getting a true surface. Anybody who has [redacted] milling-machine, can grip the valve body in [redacted] machine-vice on the miller table, and get [redacted] true surface in two wags of a dog's tail, by running it under a cutter on the arbor; if the cutter isn't wide enough to do the full surface in [redacted] cut, take two or more bites without shifting the height adjustment of the table. The block [redacted] be also held in a machine-vice attached to a vertical slide, and traversed across [redacted] end-mill or slot-drill held in the three-jaw, similar to the method described for axlebox milling. Any toolmarks should be removed by rubbing [redacted] a file [redacted] above, or on [redacted] bit of fine emery-cloth laid at the edge of the lathe bed.

Valve and Actuating Gear

The valve is simply [redacted] ½-in. square block of bronze, ¼ in. thick, trued up [redacted] one side by the rub-on-file-and-emery-cloth process mentioned above. A No. 48 hole is drilled clean through the thickness, and tapped 7-B.A.

The T-shaped arm which screws on to the end of the regulator rod, and operates the valve by [redacted] of the two connecting links, is made from [redacted] ¾-in. length of ½-in. × ¼-in. bar; bronze [redacted] gunmetal for preference, but brass will do if nothing better is available. File or mill away ⅛-in. of the two sides, [redacted] shown, [redacted] that the [redacted]



Regulator and superheater

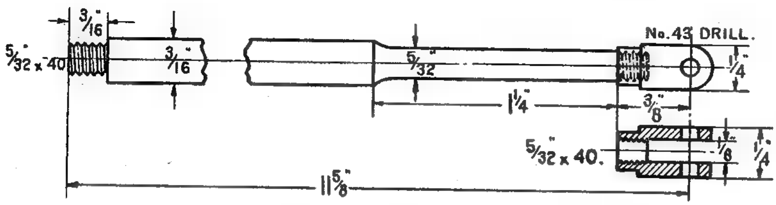
Arrangement of superheater headers

Plan of regulator valve

fits nicely in the slot in the valve body. Drill a No. 48 hole clean through the head, and tap it 7 B.A. Note: both this hole, and the one in the valve, *must* go through dead square; [redacted] if you have [redacted] drilling machine, make [redacted] centre-pop in the correct position, chuck in four-jaw with the pop-mark running truly, and drill and tap from the lathe tailstock chuck. Same applies to the 5/32-in. × 40 hole in the stem of the tee.

length to $\frac{7}{16}$ in. diameter, screw $\frac{7}{16}$ in. × 32, and part off [redacted] full $\frac{1}{8}$ in. from the shoulder. Re-chuck in [redacted] tapped bush; face the other end, centre, drill through No. 21, open out to $\frac{1}{8}$ in. depth with 7/32-in. drill, and tap $\frac{1}{4}$ in. × 40. Make [redacted] gland to suit, from $\frac{5}{16}$-in. hexagon rod, bronze or gunmetal for preference, $\frac{1}{2}$ in. long overall. Drill No. 21 also.

The regulator rod is [redacted] piece of $\frac{3}{16}$-in. round



Regulator-rod

The two connecting links are filed up from 3/32-in. × $\frac{3}{16}$-in. bronze or brass strip, and drilled [redacted] shown; the four screws are turned up from $\frac{1}{4}$-in. bronze rod. The plain part under the head, should be [redacted] full 3/32 in. wide, but only just full enough to allow the link to move up and down, not sideways. If there is any appreciable side movement, the valve won't be guided truly up and down the port-face.

A bracket is needed to support the end of the regulator rod, and this can be made from a bit of $\frac{1}{8}$-in. × $\frac{3}{8}$-in. brass rod, bent to [redacted] right-angle. I have shown a regular "two-stage" bend, but it doesn't matter if the angle is rounded (says Pat) as long as it misses the bottom edge of the dome flange; see drawing of complete assembly. The hole for the regulator rod is made with No. 11 drill, centre of hole being $\frac{1}{2}$ in. from the top of bracket.

How to Erect the Valve Body

On the centre-line of top of boiler, make [redacted] centre-pop $\frac{3}{16}$ in. ahead of dome bush, and another $\frac{7}{16}$ in. farther on. Drill No. 30, and countersink. Whilst on the job, drill the two No. 34 holes for the bracket screws, behind the dome bush, at $\frac{3}{16}$ in. and $\frac{5}{16}$ in. spacing. Insert the body through the dome hole end-up, holding with pliers—don't let it slip!—turn right way up, and hold in position, with the step bearing against the outer side of the dome bush spigot as shown. See that the body is quite central, then run the No. 30 drill in the holes in barrel, making countersinks on the top of valve body. Remove same, drill the countersinks No. 40, tap 5 B.A., replace, and secure with brass countersunk screws.

Screw a link to each side of the T-head, place valve between links, put the screws in tightly—the links must be free on the plain part—and drop the valve on to the port face, the stem of the "T" going down nicely in the slotted end. With [redacted] spot of cylinder oil between the rubbing surfaces, the valve should slide freely, and at the [redacted] time be perfectly tight when closed.

The Driver's End

On the centre-line of the backhead, at $\frac{3}{4}$ in. from top of wrapper, drill a 13/32-in. hole, and tap it $\frac{7}{16}$ in. × 32. Chuck [redacted] bit of $\frac{5}{8}$-in. hexagon brass rod in three-jaw, face the end, turn down $\frac{1}{2}$ in.

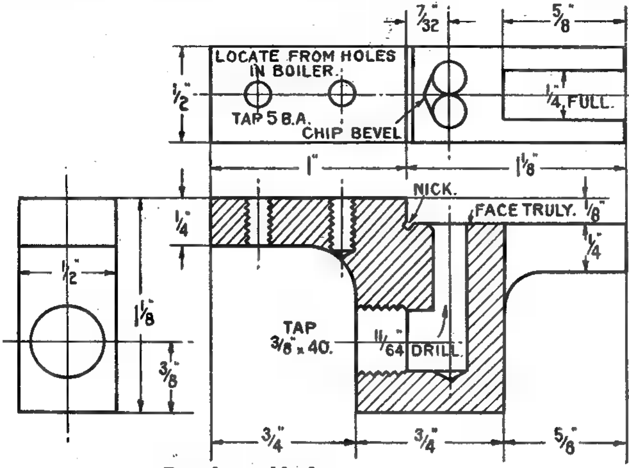
rustless steel or hard bronze rod, 11$\frac{5}{8}$ in. long. One end is turned down to 5/32 in. diameter, for 1$\frac{1}{4}$ in. length, in order to get [redacted] smaller and neater gland, of the size mentioned above. The end is screwed 5/32 in. × 40, for $\frac{1}{8}$ in. length. The other end is turned down for $\frac{3}{16}$ in. length, to 5/32 in. diameter, and also screwed 5/32 in. × 40. On the longer reduced end, fit [redacted] fork or clevis [redacted] shown; this is made from $\frac{1}{4}$-in. square steel rod, by the same process described for valve-gear forks, [redacted] repetition is unnecessary.

Insert the rod through hole in backhead; and when it appears at the dome hole, slip the bracket over it, then screw it into the bottom of the "T." Slip the gland and stuffing-box over the footplate end, and screw right home, with [redacted] smear of plumbers' jointing on the outer threads. Pack the gland with [redacted] few strands of graphited yarn and screw the fork on. Now adjust the bracket to the position shown in the general arrangement and secure with two 6-B.A. brass countersunk screws, locating them same way as described for the valve body. A smear of plumbers' jointing under the heads, should keep them free from leakage, or they can be soldered over, if you so desire.

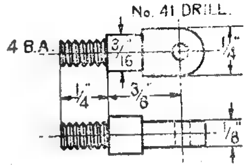
The cover of the dome bush can be turned up from a casting; if no special castings are provided (there *should* be plenty!) a cylinder-cover casting could be utilised. It is attached by twelve 3/32-in. or 7-B.A. countersunk screws, just like [redacted] cylinder cover. A small flat spring is attached by [redacted] brass screw, to the underside, to press on the valve, and prevent scale and grit getting between valve and port-face when the engine is cold. Steam pressure keeps the valve on the face when the engine is in steam. The spring should be [redacted] bit of strip bronze, as used for the brush springs of small electric motors and dynamos. Put [redacted] 1/64-in. Hallite or similar gasket between the dome flange and cover. The outer dome casing may be [redacted] sheet-metal stamping, or turned from a casting; in either case it is attached by [redacted] single countersunk screw in the middle, and if this is removed, at any time when necessary, [redacted] spot of cylinder oil may be dropped through the hole, on to the valve, which will keep it steamtight, and make for easy working.

The driver's handle is turned from a piece of $\frac{1}{4}$-in. round rod, nickel-bronze for preference, the part above the grip being filed flat, to fit the fork [redacted] the regulator rod. Drill the pinholes No. 41.

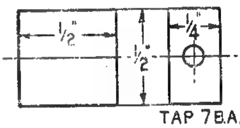
The lug for carrying the anchor-pin is turned up from [redacted] bit of $\frac{1}{4}$-in. steel rod, [redacted] shown, and screwed into the backhead directly above the stuffing-box flange. It is connected to the handle by two links, similar to the valve links ; but drill them No. 43, and squeeze in pieces of 3/32-in. silver-steel for pins. No stops [redacted] required for "on [redacted] and [redacted] off" positions, [redacted] the valve comes up against the dome bush when shut, and the shoulder on the regulator rod comes up against the stuffing-box in the full-open position. The natural friction of the valve, and the gland, combine to prevent the regulator "blowing open" by steam pressure on the end of the rod ; and the regulator will "stay put" in any position in which it is placed.



Regulator block



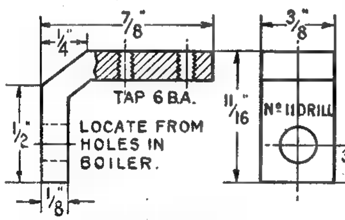
Lug for regulator handle



Valve

Main Steam-pipe and Flange

The steam-pipe between regulator and the flange on the smokebox tubeplate is a piece of $\frac{3}{8}$-in. copper tube 10 in. long, not less than 20-gauge, or it will break at the ends of the screwed portions. It may be 18-, or even 16-gauge, without any fear of the flow of steam being impeded. Put $\frac{1}{4}$ in. of $\frac{3}{8}$-in. $\times$ 40 thread on one end, and about $\frac{1}{2}$ in. of $\frac{3}{8}$-in. $\times$ 32 on the other. Anoint the finer end with [redacted] taste of plumbers' jointing, poke it through the hole in the smokebox tubeplate, and screw it into the regulator valve body. Beginners note that a round file pushed into the end, will form an effective "screwdriver."

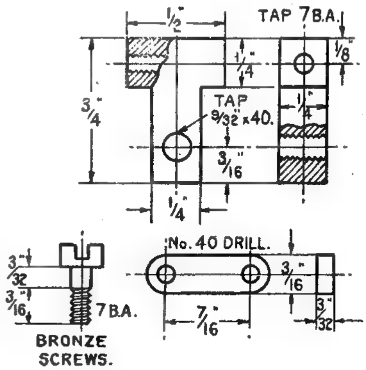


Regulator-rod bracket

The steam flange [redacted] be made from a casting, or from $\frac{7}{8}$-in. round or hexagon brass rod ; the latter is easier to screw in. A piece $\frac{13}{16}$ in. long is needed. Chuck in three-jaw, face, centre, and drill through with $\frac{5}{16}$-in. drill. Open out to about $\frac{1}{2}$ in. depth with letter R or 11/32-in. drill, and tap $\frac{3}{8}$ in. $\times$ 32. Turn down $\frac{1}{2}$ in. of the outside to $\frac{5}{8}$ in. diameter, and further reduce $\frac{5}{16}$ in. length to $\frac{1}{2}$ in. diameter ; screw $\frac{1}{2}$ in. $\times$ 32. Reverse in chuck, and skim the other end to get [redacted] true face. Smear threads with plumbers' jointing, screw it [redacted] the projecting scrap of steam-pipe, and carry [redacted] until the shoulder is right home against the smokebox tubeplate.

Superheater

As the superheater is made exactly the same as that described for *Doris*, not so very long ago, there is hardly any need to go into minute details of construction ; [redacted] brief summary should suffice. The steam flange is [redacted] $\frac{1}{2}$-in. slice of $\frac{7}{8}$-in. brass rod, truly faced, with a $\frac{5}{16}$-in. hole in the face, and a similar hole drilled through the thickness, as shown in section. A half-round groove is filed across this hole ; and a $3\frac{1}{8}$-in. length of $\frac{7}{16}$-in. copper tube, closed at both ends with discs of $\frac{1}{16}$-in. sheet copper, or slices parted off a rod, is silver-soldered to it. Don't forget the communicating hole, or you'll wonder why she doesn't start when you open the regulator ! The four elements



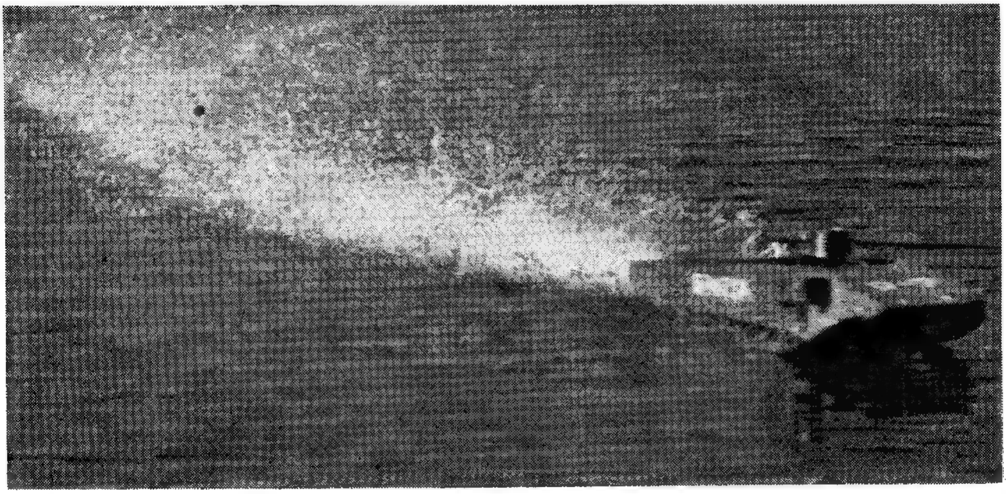
Arm and connecting links

(*Continued on page* 677)

THE SOUTHAMPTON REGATTA

THE Southampton Club held their first post-war regatta recently under ideal weather conditions. Boats from Lymington, Guildford, Orpington, Blackheath and Victoria Park all helped to make a good day's sport, although numbers were rather weak in the speed events.

Scoring in the steering competition was very good on average and we will not mention the name of a member whose boat persisted in children's classic, it was nearly a case of "all must have prizes." Although Mr. Martin had to scratch his "B" class steamer and Mr. Cockman encountered a great deal of trouble in getting a run with *Ifit 7*, it was a good day for flash steamers which won "A," "B" and "C" classes. "D" class was won by a new Southampton boat, Mr. Pacey's *Gymp*. This boat ran very smoothly, and, though not yet old enough



Mr. Hodges' "Sparta" at speed

"homing" in a small circle whatever the rudder setting! The winner was Mr. Dowling's *Sue*, with Mr. Speller's *Lantana* taking second place from the next two boats by a margin of only one point.

Everybody Had A Go

The same thirteen boats followed on with the nomination race. Some competitors had not entered for this type of event before, but everybody had a try and percentage errors ranged from 6.7 to 220.0. Mr. Mitchell (Southampton), with *Sea Maid* deserves a mention, as with an error of 8.5 per cent. he was a very close third to Mr. Falconer's *Golden Maria* and Mr. Duncan's *Zoe*.

During the lunch interval, demonstrations of R/C were given by Mr. Compton with *Con Rad* and Mr. Owen with *Capetown Castle*. The latter is a very fine model of one of the Castle Line boats and it was good to see such a nicely detailed job demonstrated on the water. The R/C on both boats was very effective, although the addition of "asdic" for locating and avoiding weeds in some parts of the lake would be an undoubted advantage!

The speed events were run after lunch and numbers were such, that, to quote a well-known to grow a tail, is obviously related to the well-known *Sparky*. The only entry in the "C" Restricted class, Mr. Combs with a new boat, was unable to complete a run.

The last speed event was the Hamtun Trophy over a 1,000 yd. distance, *Firefly IV* was the only boat to finish the course, winning at 37.4 m.p.h.

Balloon "Busting"

The final event of the day was the traditional Southampton sport of balloon "busting," each straight running boat being fitted with a pin attached by plasticine. We in Southampton can assure critics of the title of this event that balloons were definitely "bust" as all present can verify. The event was commenced in an organised manner, but rapidly degenerated into something approaching a riot. In the scramble of boats Mr. Dicker's *Penang* came out none the worse for being run over by a boat many times her size, and Mr. Martin was seen at the conclusion chasing a pin with a bunch of balloons. There was some difficulty in keeping the score, but in the opinion of the judge the champion balloon buster was *Golden Maria* closely followed by Mr. Finmore's *Rita Mary*.

The day was concluded by Mrs. Martin presenting the prizes at the lakeside.

Results

Steering.—1st Mr. Dowling (Lymington, *Sue*, 13 pts. 2nd Mr. Speller (Southampton) *Lantana*, 9 pts.

Nomination.—1st Mr. Falconer (Blackheath), *Golden Maria*: error 6.7 per cent. 2nd Mr. Duncan (Orpington), *Zoe*: error 8.0 per cent.

"*D*" *Class*, 300 *yd.*—1st Mr. Pacey (Southampton), *Gymp*: 24.7 m.p.h. 2nd Mr. Trodd (Southampton), *Diabolo*: 16.3 m.p.h.

"*C*" *Class*, 300 *yd.*—1st Mr. Martin (Southampton), *Zephyr*: 30.1 m.p.h.

"*B*" *Class*, 500 *yd.*—1st Mr. Jutton (Guildford), *Vesta II*: 49.9 m.p.h. 2nd Mr. Hodges (Orpington), *Sparta*: 30.1 m.p.h.

"*A*" *Class*, 500 *yd.*—1st Mr. Pilliner (Southampton), *Ginger*: 49.9 m.p.h. 2nd Mr. Puntis (Southampton), *Firefly IV*: 39.1 m.p.h.

Hamtun Trophy, 1,000 *yd.* (*Open*).—Mr. Puntis (Southampton), *Firefly IV*: 37.4 m.p.h.

Mr. Puntis and his son with "Firefly IV"

Scott Paine Trophy, 500 *yd.*, (Southampton Club).—Mr. Pilliner (Southampton), *Ginger*: 49.9 m.p.h.

Balloon "Busting"—1st Mr. Falconer (Blackheath), *Golden Maria.* 2nd Mr. Finmore (Southampton), *Rita Mary.*

"L.B.S.C."

(*Continued from page 675*)

are made from 7/32-in. × 20-gauge copper tube ($\frac{1}{4}$-in. would do, if this size is not readily available, but it leaves less area for heated gases to pass) the length of all eight tubes being $11\frac{3}{4}$ in. The firebox ends are joined by block return bends, made from blocks of copper, $\frac{5}{8}$ in. square and $\frac{5}{16}$ in. thick; drill the 7/32-in. holes for the tubes, on the slant, so that the holes break into each other, as shown in the section. The tubes are brazed in. using brass wire or Sifbronze rod; *not* silver-solder at this end of the doings. It only needs the block and tubes to be bright red instead of dull red, when applying the wire or rod. Soften the other ends of the tubes, by making them redhot before quenching the elements in the pickle bath.

The hot header is made from a similar bit of $\frac{7}{16}$-in. tube, with plugged ends, same as the wet header. Drill holes for the tubes as shown, in both headers. In the wet one, drill an additional $\frac{1}{8}$-in. hole for the snifting-valve pipe. In the hot one, drill two $\frac{1}{4}$-in. holes, $1\frac{1}{2}$ in. apart, for the pipes leading to the cylinders. These are $\frac{1}{4}$-in. copper, and are furnished with $\frac{3}{8}$-in. × 26 or 32 union nuts and cones on the outer end; if made 4 in. long, you'll have plenty of pipe to allow of bending easily to connect with the pipes from the cylinders, when coupling up after the boiler is erected. The bit of $\frac{1}{8}$-in. pipe for the snifting valve, is 6 in. long.

The whole issue can be then assembled, an easy job for the veriest Billy Muggins.

Bend up the ends of the upper elements—a bit of rod poked in the end of the tube, will provide ample leverage—and fit them into the holes in the wet header. Fit the bottom pipes, and the short steam pipes, into the hot header. Put in the bit of pipe for the snifting valve, tie the circular flange to the wet header with a bit of iron binding-wire, give all the joints a dose of wet flux, and silver-solder the lot at one fell swoop. Silver-solder of No. 1 grade, or "Easyflo," is O.K. for the smokebox end. After pickling, well wash in running water, to clear all the brazing residue out of the pipes; if any is left in, it will play merry dickens with your pistons and valves. Finally, drill three No. 34 holes for screws, in the flange—if you have not already drilled them when drilling the centre hole—and attach it to the steam-pipe flange with three 6-B.A. screws, as shown in the section of the whole doings. Put a 1/64-in. Hallite or similar gasket between the two faces. The block bends should just project into the combustion chamber as shown; this prevents "birds' nests" of cinders being formed, and blocking the flues. They must not project into ordinary fireboxes where they would be exposed directly to the fire, otherwise they would soon burn out.

Shrink Fits in Plastics

by P. W. Blandford

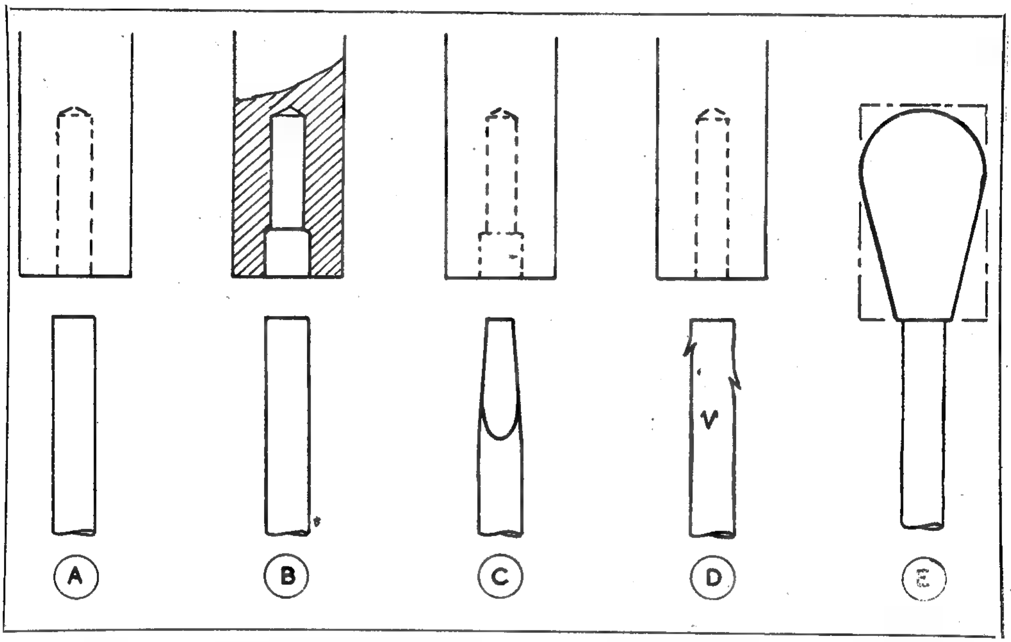
HANDLES for tools and kitchen utensils are much better in plastic than wood. Casein rods [redacted] obtainable in round sections of many colours, while Catalin rods [redacted] be had in hexagonal, fluted and many other sections in any colour, either opaque, translucent [redacted] transparent. Casein is slightly hygroscopic so should not be used for handles likely to get wet frequently, nor for insulating purposes. It is, however, cheaper than Catalin.

Handles may be simply and rigidly fixed by shrinking. Properly done, the handle is there for a lifetime. An undersize hole is drilled, then the plastic handle softened and driven on. Basically, that is all there is to it, but there [redacted] one or two points to watch.

Both plastics become quite soft after a few minutes in boiling water. The period varies with thickness, except that very prolonged heating or frequent reheating seems to make the plastic harden slightly and tend to crack: ¾-in. rod needs about three minutes.

The amount that the hole is smaller than the rod is not very important except that if the handle is not much thicker than the rod, drilling too much undersize will cause cracking. A thick handle can have a smaller hole. Quite [redacted] small difference will result in [redacted] tight fit. As [redacted] guide, a 7/64-in. hole will usually do for [redacted] ⅛-in. rod.

For [redacted] tool which is not likely to be subject to much strain, there is [redacted] need to prepare the end of the metal rod. Hold it in [redacted] vice, soften the plastic, and drive it on (*A*), with [redacted] mallet. The air being compressed will escape down the side of the rod. Be careful not to drive the rod farther than the end of the hole. In transparent material you can watch the rod enter, but for opaque handles it is wisest to mark the rod.



If the handle is started on the skew there is a risk of cracking at the mouth of the hole. This can be avoided by drilling the hole full-size for [redacted] short distance (*B*).

For tools subject to torque, such as screwdrivers, additional grip may be given by filing the end square (*C*). I have a set of screwdrivers made from silver-steel rod, with Catalin handles fixed in this way, and they have never given any trouble.

For tools which have to withstand pulling, [redacted] few small teeth [redacted] be raised on the tang with a small cold chisel (*D*).

Boiling has little effect on the finish of the plastic, so that handles may be polished completely before fitting if desired. A light rub with the final polish after shrinking will restore full brilliance. For jobs where the plastic has to be very thin [redacted] the mouth of the hole it is wisest to shrink the handle [redacted] and turn it down afterwards (*E*).

When you have finished equipping your workshop with brilliantly-coloured handles, you will probably find the wife [redacted] produce some household cutlery with damaged handles, which would benefit by the same treatment!

*Making Aquarium Accessories

by A. R. Turpin

THE basic design is shown in Fig. 5 and it consists of [redacted] field coil mounted on [redacted] U-shaped core built up of stampings that could be cut from ordinary transformer laminations. The pole faces [redacted] machined and toothed. The rotor consists of [redacted] cobalt steel bar magnet, to each end of which are screwed two toothed cheeks which form the poles of the rotor. In this [redacted] the teeth of [redacted] cheek are always north, and that of the other south polarity; this polarity being induced by the permanent magnet. Now that the left-hand pole of the electro-magnet is south, if the teeth of rotor pole [redacted] "like" they will be repelled, and [redacted] the other poles will obviously be north, they also will be repelled, and the rotor will tend to take up [redacted] position [redacted] that the teeth on the poles of the electro-magnet [redacted] opposite the gaps between the teeth of the rotor cheeks; but as the current changes direction, and the poles their polarity, the teeth will now be attracted and the rotor will again move. This movement is only possible if the change is made slowly, and if connected to [redacted] 50 cycle supply the change would be too rapid to overcome the inertia of the rotor, and it will have to be spun [redacted] synchronous speed before it will start rotating; but this is of no great disadvantage when used for the purpose in mind. To find the synchronous speed of this type of motor the same formula is used, but in this [redacted] the total number of teeth [redacted] both cheeks [redacted] counted

$$\frac{50 \times 60 \times 2}{\text{No. of teeth}} = \text{r.p.m.}$$

A prototype motor was

*Continued from page 627, "M.E.," October 26, 1950.

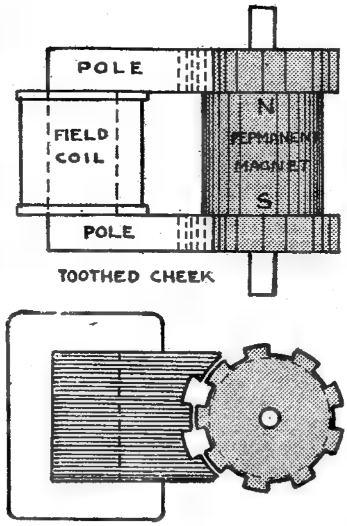


Fig. 5. The basis for the final design of synchronous motor

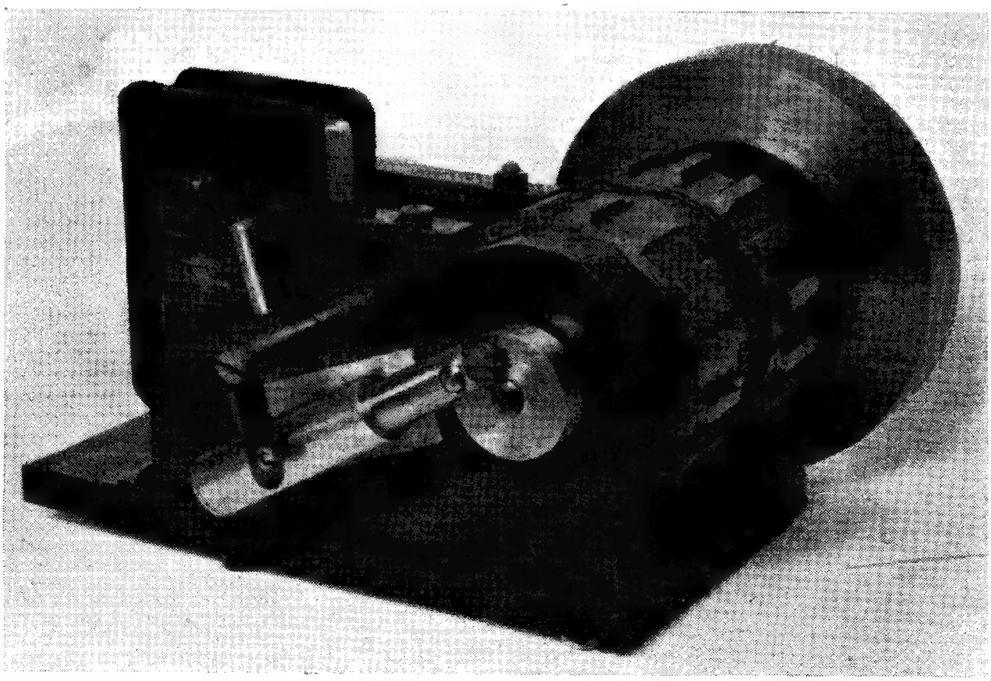


Photo No. 2. The motor pump

constructed on this principle, and is shown in photograph No. 2. Most of these clock motors have very low efficiencies, ranging from 1 per cent. to 10 per cent. and this one, at 200 r.p.m., gave 5 in. oz., for an input of 100 mA; but I think this could be improved slightly.

The suggested final design is shown in Fig. [illegible] and the construction has been simplified as much as possible. No individual dimensions have been given, because what you have in your scrap box will decide the actual size of individual motors.

I think the best part to start on is the rotor, as all other dimensions will depend on the size of this. I was unable to obtain a suitable piece of cobalt steel, but I found that I had an "Alnico" ring magnet out of a scrapped midget loudspeaker, This was 2 in. in diameter, $\frac{5}{8}$ in. long and $\frac{3}{8}$ in. thick. The edges were accurately ground, but the interior and exterior were "as cast," and as this material cannot be turned, and as I had no facilities for grinding it, some special method had to be thought out for fixing it to the pole cheeks. The section, Fig. 6, shows the ultimate method used. Start on the two cheeks first. These are turned from a $2\frac{1}{2}$ in. dia. mild-steel bar. A short length is chucked, and a recess turned $\frac{1}{16}$ in. deep, the inside diameter of which will just take the ring magnet. Centre drill, then drill right through, and ream $\frac{3}{8}$ in., enlarge to $\frac{5}{8}$ in. dia. for a depth of $\frac{1}{4}$ in., for the bridge piece recess. Remove from chuck and make a replica.

Chuck a length of $\frac{3}{4}$ in. dia. brass bar for the bridge piece; face, and skim to run true; turn down to $\frac{5}{8}$ in. dia. for length of $\frac{1}{4}$ in., centre drill, then drill and tap $\frac{3}{8}$ in. B.S.F. to a depth of $1\frac{1}{8}$ in., part off at this length. Chuck a length of $\frac{1}{2}$ in. dia. B.M.S. bar, turn down to a push fit in the $\frac{3}{8}$ in. hole in one cheek and screw $\frac{3}{8}$ in. B.S.F., with the die held in the tailstock for a length of $\frac{3}{8}$ in.; push on one cheek with the recess away from chuck, and screw on brass bridge piece. Turn down the end of this bridge piece to a diameter of $\frac{5}{8}$ in., for a length of $\frac{1}{4}$ in., remove whole assembly from chuck. Repeat the procedure with a second length of $\frac{1}{2}$ in. bar, push on second cheek, and then screw on to this bar the whole assembly previously removed from the lathe. At this point if your turning has been accurate the whole assembly will not be too badly out of truth, so chuck in the four-jaw and get it running as truly as possible, and then centre drill the protruding length of shaft, reverse, and centre the other shaft. Now place between centres, and turn down both of the cheeks to run true, with an outside diameter of $2\frac{3}{8}$ in. Mount on a dividing head and mill 15 teeth to a depth of $\frac{1}{8}$ in. I could obtain no authoritative data on the size of the teeth as compared with the gaps, some said this, and others that; so eventually I made the lands half the size of the gaps. Having milled the teeth, mount again between centres, and turn down the shafts to 1 thou. over $\frac{1}{4}$ in. dia. leaving a $\frac{1}{8}$ in. collar next to the cheeks.

Statically balance on *brass* knife edges, and the rotor is complete.

The next item is the field coil (see Fig. 7). The bobbin was built up of $\frac{1}{16}$-in. pressphan, and wound in the same way as the vibrator coil, but in this case with 5,000 turns of 36-s.w.g. enamelled wire, but as the coil is narrow, no interleaving was deemed necessary. The core was made by cutting up transformer stampings into "L's" and "I's" and then drilling the holes as previously described.

The core when assembled is clamped to a U-shaped bed which is a casting in aluminium $\frac{3}{8}$ in. thick; the tops of the "U" are machined, and then drilled and tapped 4 B.A. to take the clamping screws, under the heads of which is is a $\frac{3}{8}$ in. $\times$ $\frac{3}{8}$ in. brass plate; the laminiation being clamped firmly between this and the "U" casting. This casting is fixed to the aluminium base by means of two 2-B.A. screws which pass through elongated holes which allow a slight adjustment of position.

The whole assembly is now gripped in the machine vice mounted on the cross-slide, and the pole faces flycut out to curvature of the rotor plus 10 thou.; alternatively, a temporary steel base can be screwed to the bottom of the "U" piece, and of sufficient length so that it projects backwards 1 in. clear of the coil; this can then be gripped in the machine vice fitted to the vertical slide. It may be necessary to invert the coil if your slide has not sufficient height adjustment. Take only fine cuts, and gradually feed in until the whole pole face is curved.

Place the rotor against the curved pole faces, and mark the position of the teeth, which should be the same as on the rotor cheeks; flycut, mill, or file these out.

Next, machine up the side pieces, clamp dead square to the sides of the base, and parallel with each other, and then drill tapping holes 2-B.A. right through the base into the sides; unclamp, tap the holes in the sides, and open out the holes in the base to clearance size. Screw the sides to the base; fix the magnet in position, having previously drilled and tapped the necessary holes, noting that the sides of the core are parallel with the side pieces. Support base on parallels on a surface plate and carefully transfer the height of the core centre to the side pieces. Stand the base vertical and scribe a line half the diameter of the rotor away from the centre of the pole faces so that it crosses the previous line marked; at the point of intersection are your bearing centres.

Plain bearing can be used, but the fit must be perfect and without stiffness. The slightest suspicion of play will cause a lot of hum. For this reason I have used ball-bearings, and in this case drill and ream $\frac{1}{4}$ in. dia. holes at the points marked and then counterbore $\frac{5}{8}$ in. to a depth of $\frac{1}{4}$ in. Test your counterbore first on a scrap piece of metal to see that it gives a nice push fit for the races. Open out the remainder of the $\frac{1}{4}$-in. hole to $\frac{5}{16}$ in.

The pump is built up as shown in Fig. 7, the parts being soft-soldered together. A piece of bar is cut to length, faced at the ends and then drilled and reamed $\frac{3}{8}$ in. dia. The base for this is cut from a bar, the ends faced in the four-jaw, and then fixed in the machine vice on the vertical slide, and the necessary seat for the cylinder cut with a flycutter, taking care that this bar is lying parallel with the bed of the lathe. Turn up the necessary plug for the end, and drill the 5/64 in. hole for the air port.

The $\frac{3}{16}$-in. hole for the pivot must be drilled dead square, and this is best done before the

base and cylinder [redacted] soldered together.

The piston is cut from B.M.S. rod, and [redacted] fully honed to size, and, [redacted] there is no power available for running in, it must be a nice "velvet" sliding fit. Turn the crank disc, and crankpin, from brass and silver-steel respectively. Try the pump in position and centre-dot the position of the pivot pin hole and, using this point [redacted] centre, scribe [redacted] arc to give you the line on which to drill held by two nuts [redacted] the B.A. rod [redacted] when the final tension has been fixed [redacted] length of tube and screwed rod is substituted, this tube being cut to the exact length required, supported by [redacted] 4-B.A. cheesehead screw as shown in the drawing. The other end of the spring rests on [redacted] $\frac{3}{16}$-in. steel ball which in turn rests in [redacted] small depression drilled in the cylinder casing directly over the swivel pin.

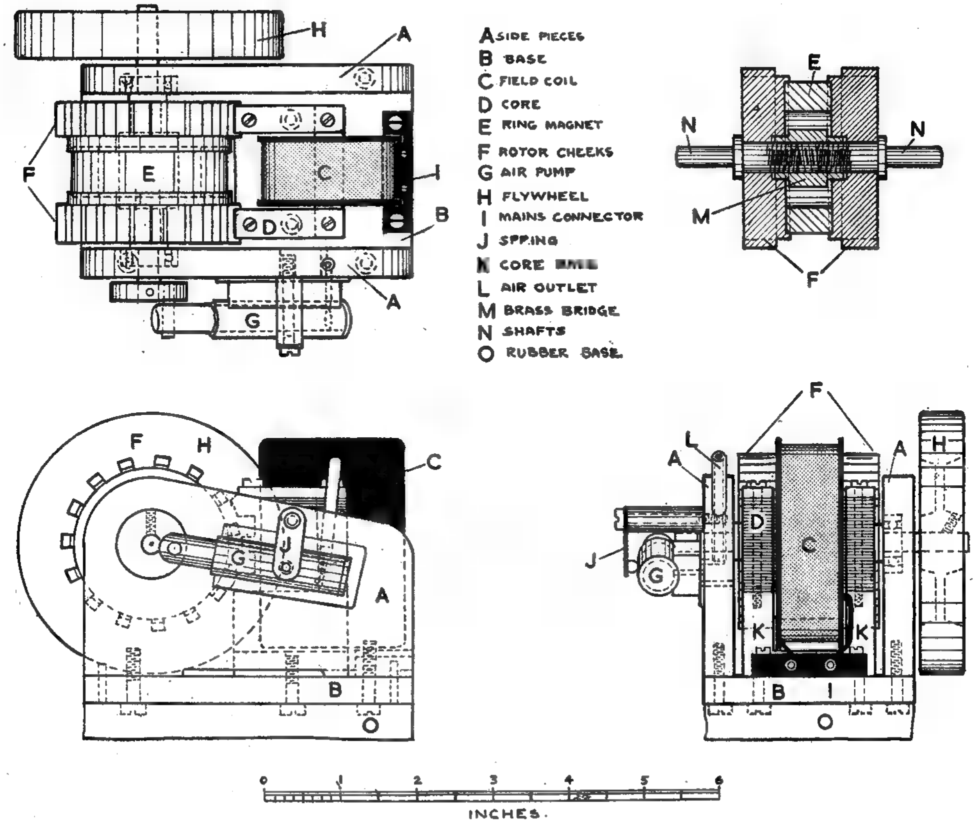


Fig. 6. The synchronous motor pump

the inlet and outlet ports, which are again 5/64 in. holes. I would mention here that when machining the side pieces [redacted] small platform should be left 1/32 in. high for the cylinder seating, which should be scraped carefully, but this should only be done if, say, piston metal has been used for the casting of the sides; but, if in doubt about the quality of the metal, screw [redacted] 16-s.w.g. steel plate to the side piece and use this [redacted] seating (see Fig. 7). The air outlet pipe is screwed into the side [redacted] shown in the drawing.

The pressure spring for the piston is mounted on [redacted] length of 4-B.A. rod screwed into the side piece. The short length of 24-s.w.g. spring has [redacted] suitable hole punched at each end, and one end is

The flywheel was turned from a steel blank, and was originally mounted solid [redacted] the shaft, and the motor worked quite well like this, but was rather difficult to start because the speed at which it was spun had to be almost exactly the synchronous speed, also sometimes the motor would stop for no apparent reason. So, [redacted] most writers recommended a flexible mounted flywheel, I modified mine, and starting certainly seemed easier, although it may be that by that time I had had more practice [redacted] also the motor [redacted] longer had the unaccountable stoppages.

With either of the pumps described it may be found that they work perfectly with the outlet tube placed in a jam jar of water, but when

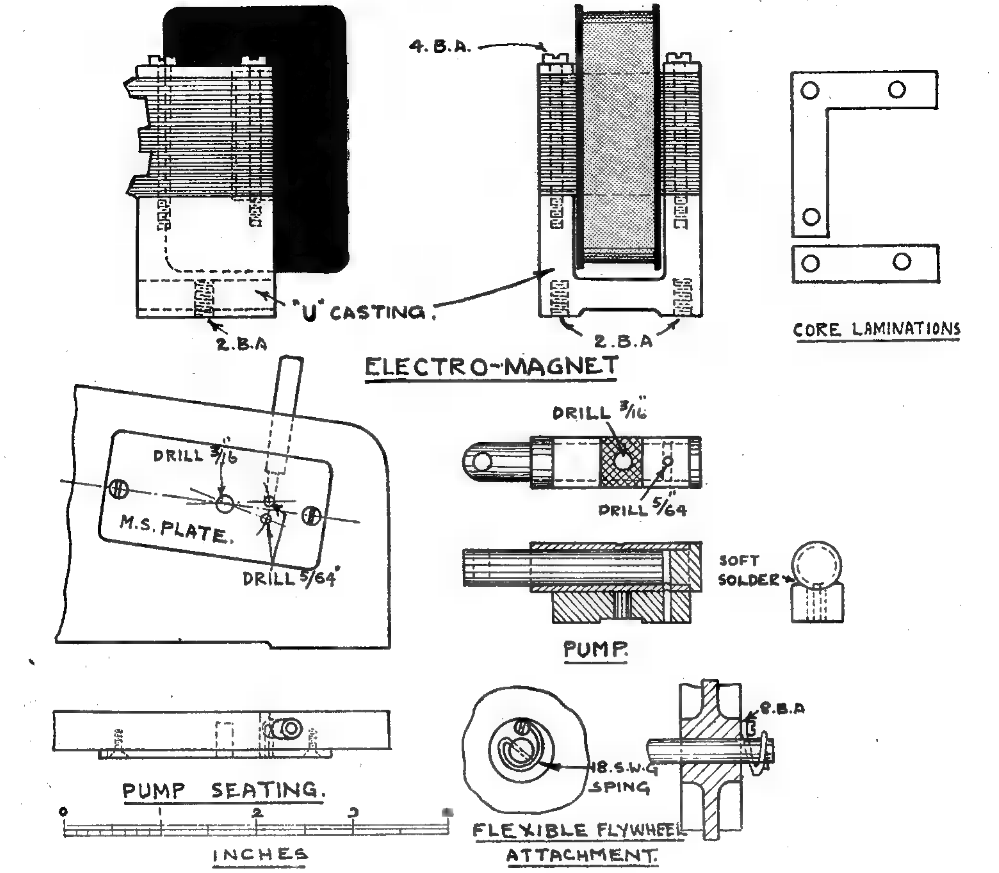


Fig. 7. Details of the motor pump

connected to a diffuser at the bottom of a deep tank the pump cannot overcome the pressure. If this happens, look to the valve seating and the spring pressure. If a glass tube is connected to the diffuser, any increase in efficiency can immediately be noted by the level of the water in the tube, which will get lower and lower as the pump pressure and efficiency is increased, until finally bubbles emerge from the diffuser, and after that the volume of bubbles will indicate the efficiency.

Fig. 8 shows a suggested method of fixing a small diffuser through a hole in the glass instead of with the usual rubber pipe trailing amongst the plant life. A non-return valve must, of course, be incorporated.

In the prototype I made no arrangement for altering the position of the core and hence the air gap, which was fixed at 10 thou., and I feel that with the flexibly mounted flywheel this gap could be reduced to 5 thou. with considerable increase in efficiency.

Finally, when the position of the side pieces and core support have been fixed, dowel pin them to the base with ⅛-in. steel dowels.

Some may object to the pulsating air flow but this may easily be overcome by making an air reservoir from a treacle tin, and if this is loosely filled with cotton wool it will act as an

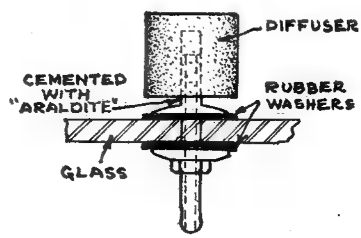


Fig. 8. A neat method of fixing a diffuser

oil mist trap and air filter, but again fit a non-return valve, otherwise the contraction of the air in the reservoir may be sufficient to start the water syphoning out of the tank.

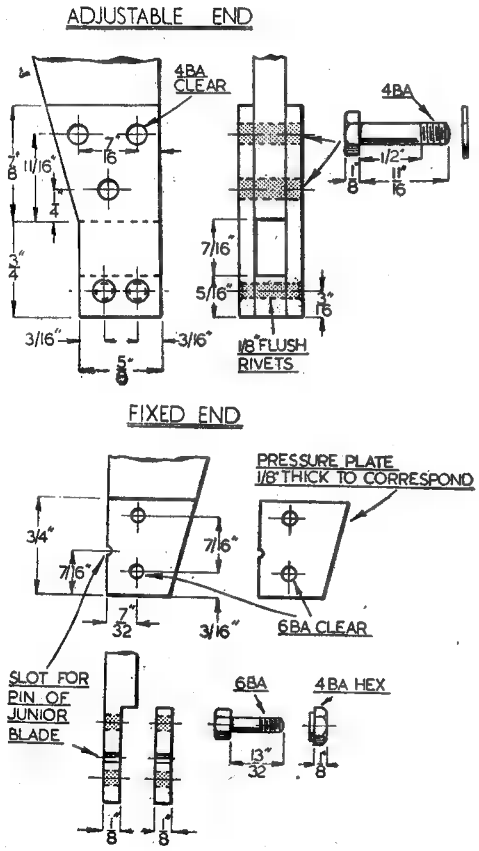
IN THE WORKSHOP

by "Duplex"

No. 75.—*A Small Power-driven Hacksaw Machine

IF the jockey bracket has been correctly adjusted, it will be found that, as the carriage is moved to and fro, the ball-races revolve first in one direction and then in the other.

Next, the bracket attached to the small-end of the connecting-rod can be secured to the frame, and when doing this the bolts should be made a close fit in their holes, as they are subjected to a rocking strain when the machine is working.



The Saw Blade Mountings

As previously mentioned, the saw mountings have been designed to take either the 6-in. Junior Eclipse blade or an ordinary 9-in. high-speed blade reduced in length to approximately 6 in.

*Continued from page 614, "M.E.," October 19, 1950.

It will be noticed that the right-hand blade mounting is set at a lower level than its left-hand counterpart by a distance of $\frac{1}{16}$ in.; in this way, the blade, when in action, is given what may be termed "climb"; that is to say, on the cutting stroke the teeth tend to press further into the work and in so doing cause the weighted beam to

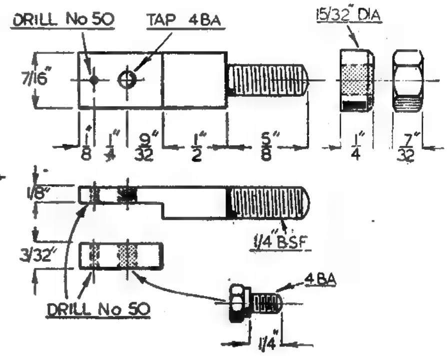


Fig. 40. The frame saw-blade mountings and adjustment-bolt

rise slightly, thereby adding to the cutting pressure. Conversely, on the idle stroke the teeth tend to leave the work face, thus giving some measure of relief to the blade. It will be remembered that the pivot joint of the beam is fitted with a friction disc, and this gives an effect akin to the ordinary form of motor-car shock absorber; with the result that, as the pivot bolt is tightened, the movement of the beam is impeded and greater pressure is required to lift the beam on the cutting stroke, and at the same time the downward movement of the beam on the idle stroke is slowed and some relief of the pressure on the saw teeth is thus obtained.

As shown in the working drawings, Fig, 40, at the adjustment end of the frame the blade is secured with the standard form of fixing and is clamped to the draw-bolt with a pressure plate.

This arrangement differs in no way from the ordinary hand hacksaw blade mounting, except perhaps that, in order to ensure exact location of the blade, the parts are very accurately fitted and no shake is permitted. As will be seen, the fixed mounting at the other end of the frame is of special construction to accommodate the shortened blade with its modified form of attachment. Here, again, a pressure plate is used to clamp the blade, and the design of the two blade mountings ensures that the blade is rigidly held and, when under tension, it is located to lie exactly in the vertical plane and on the long axis of the saw frame.

The Saw Blade

Various methods of shortening and re-forming the end of a 9-in. high-speed steel blade were tried ; breaking the blade off to length was not found to be satisfactory, and even then the problem of adapting the shortened end to provide [redacted] means of attachment had to be solved. It [redacted] not found possible to soften the blade sufficiently by heating, and had this been achieved it is probable that the cutting teeth would also have been rendered too soft for use. Finally, it was decided to cut off the unwanted end of the blade by using [redacted] ordinary cut-off wheel mounted on the grinder spindle ; there is no difficulty in doing this, as a wheel of this type will cut through the blade in a few seconds. The slots shown in Fig. 41 for securing the blade in its mounting were then marked out and ground to shape by again employing the cut-off wheel. It would not [redacted] unreasonable to suggest that this method of shortening the blades is suitable for use in the small workshop, for a cut-off wheel is easily mounted and costs only about 3s. ; moreover, [redacted] batch of six blades which will serve for [redacted] long period, can easily be dealt with in [redacted] few minutes.

The tension pins fitted to the saw mounting are best made of silver-steel in order to resist the shearing action of the blade slots. It is advisable to countersink the location holes drilled in the tension-bolt and its pressure plate for accommodating the Junior blade, [redacted] in some blades the fitting of the tension-pin will be found to have set up [redacted] burr which would hinder the blade from seating correctly.

When fitting the blade for use, there is no need to tighten the adjustment nut to give excessive tension ; for the tension will be sufficient to keep the blade rigid and to give satisfactory cutting if the blade is tightened until it gives [redacted] clear note when plucked with the finger nail. Although the illustrations show [redacted] saw frame suitable for [redacted] short blade, if desired, the frame can be made correspondingly longer to take a standard 9 in. blade without greatly sacrificing rigidity.

The Machine Vice

As previously mentioned, the Myford machine vice was selected, as it is of suitable size and, moreover, it is very accurately made and can readily be fitted to the baseplate of the machine. A single bolt is used to clamp the vice in position, and for this purpose the baseplate is drilled in accordance with the drawing, Fig. 42. The method of fitting the clamp-bolt to the soleplate of the vice is illustrated in Fig. 43, and the dimensions of the parts are given in Fig. 44.

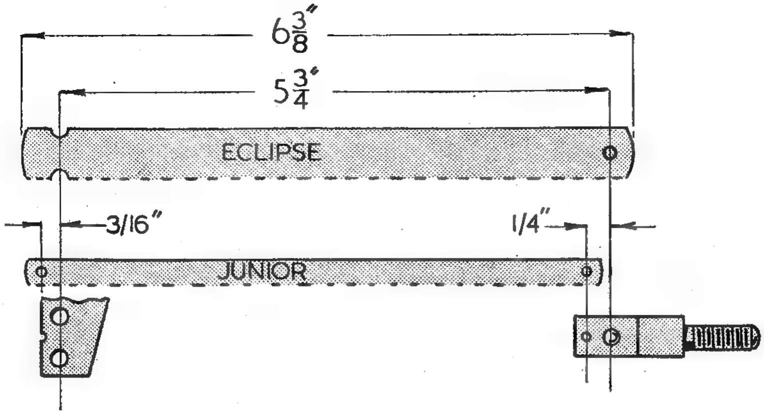


Fig. 41. Showing the relative positions of the two blades when mounted in the frame

To allow for angular sawing, the vice can be swung to one side, but, [redacted] this may not often be required, [redacted] hexagon nut is fitted to the clamp-bolt instead of [redacted] hand lever.

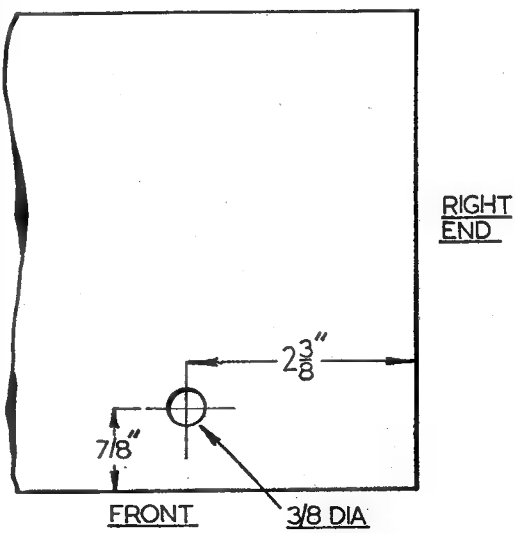


Fig. 42.—Location of the vice clamp-bolt, in the base plate

The illustrations show that the nearside bolting flange of the vice soleplate has been removed to give clearance for the saw blade at the lowest point of its travel ; the other bolting flange has, however, been retained, [redacted] that, if

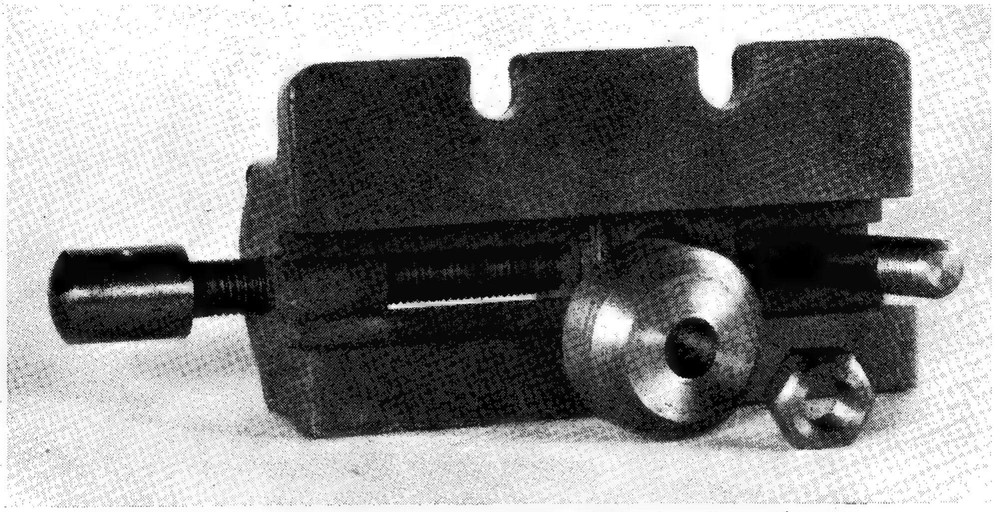


Fig. 43. Underside of vice, showing clamp-bolt, collar and nut

required, a second clamping-bolt can be fitted, but for normal usage the single bolt will be found adequate.

The Wheel Guard

Not only does the wheel guard afford protection, but when neatly fitted it also enhances the appearance of the finished machine. The material used to make this component was a length of duralumin strip $\frac{5}{8}$ in. wide and $\frac{1}{8}$ in. thick, but lighter material can quite well be employed as the guard is well supported by its attachment brackets and has to bear but little strain. What-

(*Continued on page* 687)

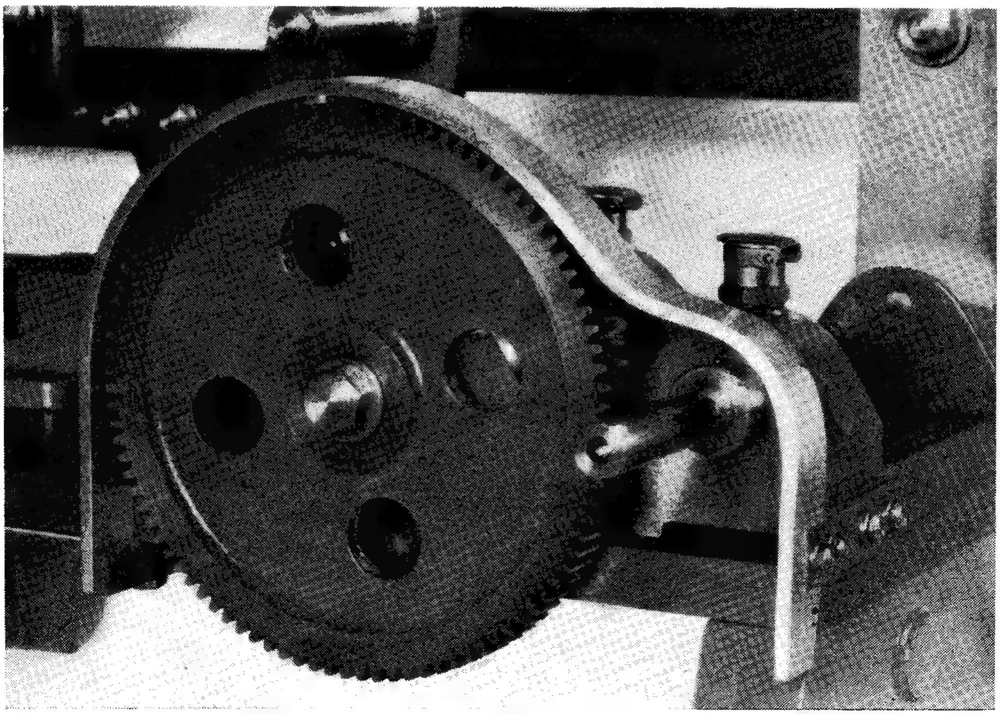


Fig. 45. The wheel guard with its attachment brackets

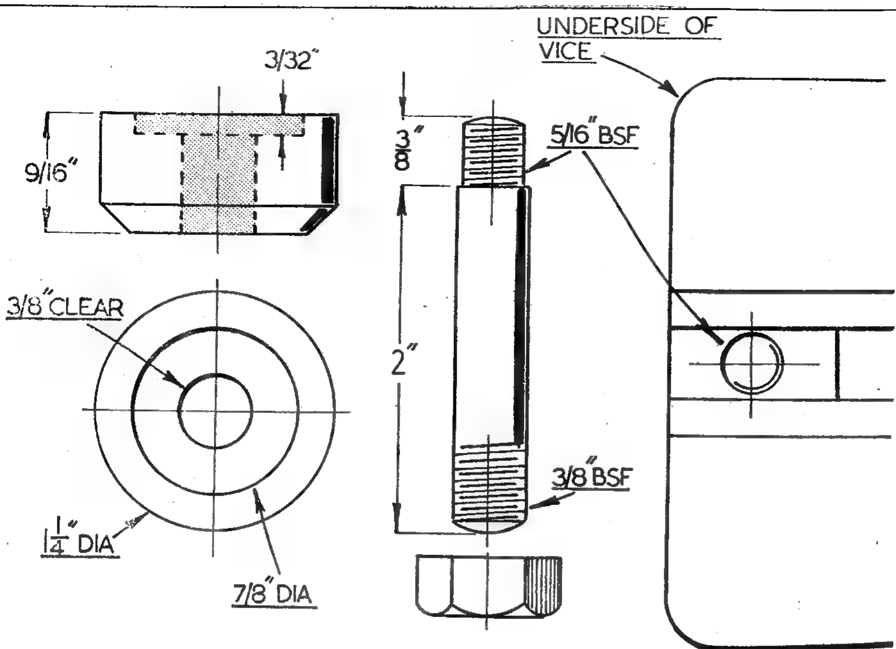


Fig. 44. *The vice clamp-bolt*

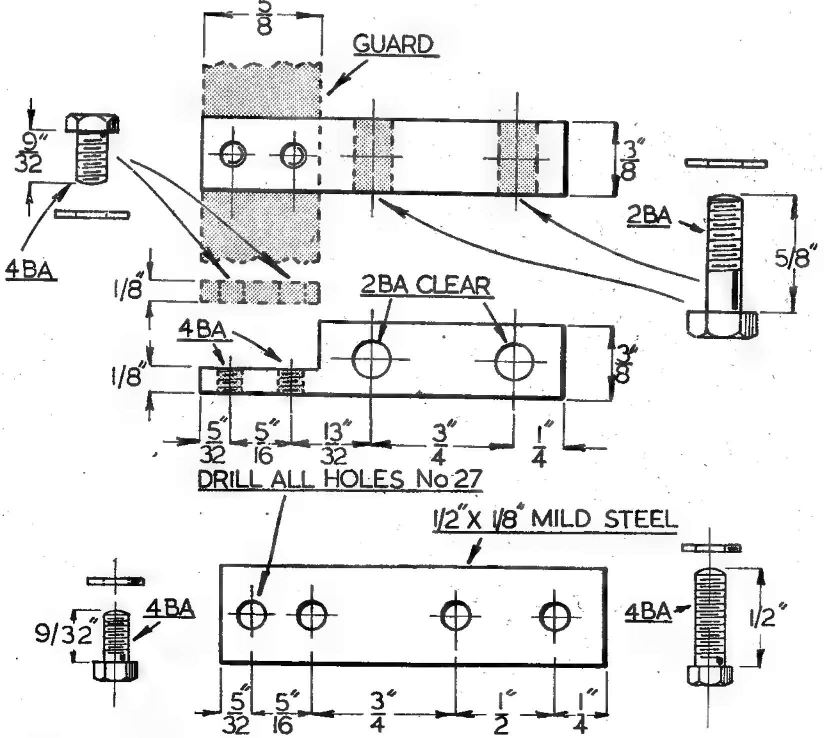
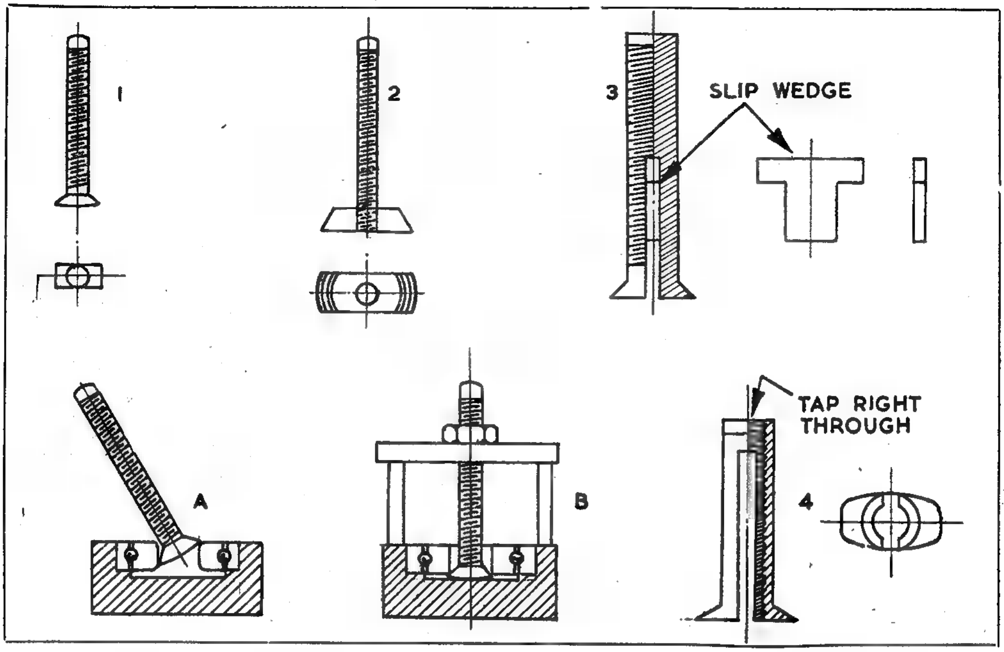


Fig. 46. *Above—The left-hand guard bracket attached to the baseplate ; Below—The right-hand bracket secured to the casting*

Extracting Ball-Races from Blind Holes

by R. H. Fry



HERE are some notes on removing ball-races from blind holes. Special tools can be bought, but this is hardly worth while for the odd job.

First, I would remind readers that, if the housing is aluminium, immersion in very hot water will often expand the housing so that the race will fall out. Failing this, [redacted] extractor [redacted] be made in one or other of the ways indicated in the sketch. Select [redacted] suitable screw (6-B.A. is about right for bearings with $\frac{3}{16}$ in. bore), and shape and size head so it can just be inserted in the bearing, it will engage in the small countersink at rear of bearing; a bridge plate with packing-pieces or piece of tube arranged [redacted] [redacted] *B* will enable race to be withdrawn. Approximate shape of screw-head [redacted] shown at (1).

Screws for larger sizes [redacted] be made up [redacted] at (2) or sometimes a coach bolt can be adapted, the idea being to keep the stem of the screw [redacted] small as possible. If the bearing is in [redacted] deep hole, [redacted] screw can be slotted as (3) and after springing into the hole, is expanded with a slip wedge.

Another method is [redacted] split bush (4) expanded by a screw passing through and pressing on the end of the blind hole, or pulling [redacted] before [redacted] at *B*.

In the Workshop

(*Continued from page 685*)

ever material is used should have its surface cleaned and finished before the bending operation is undertaken. As will be seen in the photograph, the guard follows roughly the contour of the wheels at a distance of about $\frac{1}{16}$ in. from the teeth. At the outset, [redacted] length of stout wire may be bent to the required shape to act [redacted] a template during the final bending operation. For forming the major curvature, [redacted] 100-tooth change wheel was used as this is 1/5 in. larger in diameter than the 96-tooth wheel fitted to the machine; the remaining, smaller curvatures were bent by gripping [redacted] piece of round bar in the vice to act as a former.

The method of fitting the two attachment brackets is illustrated in Fig. 45, and the dimensions of the parts are shown in Fig. 46. This is a straightforward piece of work and does not require explanation; nevertheless, the appearance will be unsightly unless the work is neatly carried out and hexagon-headed screws and washers of appropriate size are fitted.

The constructional work on the actual working parts of the machine is now complete, and it remains to describe the fitting of the automatic cut-out gear, [redacted] illustrated in the photographs, together with the electrical wiring system connecting both the main switch and the Burgess micro-switch in the motor supply circuit.

(*To be continued*)

The "Handy-Utility" Electric Tool Kit

ONE of the most important developments in tool design of recent years has been the extensive application of power drive to tools which were formerly manipulated and driven by hand. Not only does this result in [redacted] saving of time and manual energy, but it also enables full attention to be given to the control of the tool, with consequent improvement in accuracy of work. While main machining operations are, generally speaking, best carried out by bringing the work to the tool, there are always many operations in fitting, erecting and assembly work where it is both more convenient and efficient to bring the tool to the work. Special-purpose tools, driven mostly by electricity or compressed air, are very extensively used in large and small industries for grinding, scratch-brushing, polishing, filing and drilling, and are equally useful on work inside the factory or [redacted] on location."

In amateur and small industrial workshops, the provision of separate power tools for each special application is often impracticable on grounds of economy, and there is a strong case for multi-purpose tools which [redacted] be adapted to various purposes, and energised by [redacted] single power unit. Many such devices have made their appearance, and their general versatility is beyond question, but there is always the possibility that in attempting to make a single tool do everything, it may do nothing really efficiently. In the best examples of such tools, however, practical considerations are very carefully studied, and the results obtained in any of the many applications of such tools leave no doubt [redacted] to their utility.

The latest of these portable multi-purpose tools to come to our notice is the "Handy-Utility" electric tool, which is a product of Black and Decker Ltd., of Harmondsworth, Middlesex, whose long experience in the manufacture of power tools needs no commentary. We have been given facilities for testing out one of these tools in our own workshop, and are very favourably impressed by its possibilities, [redacted] the class of work likely to be encountered by our readers.

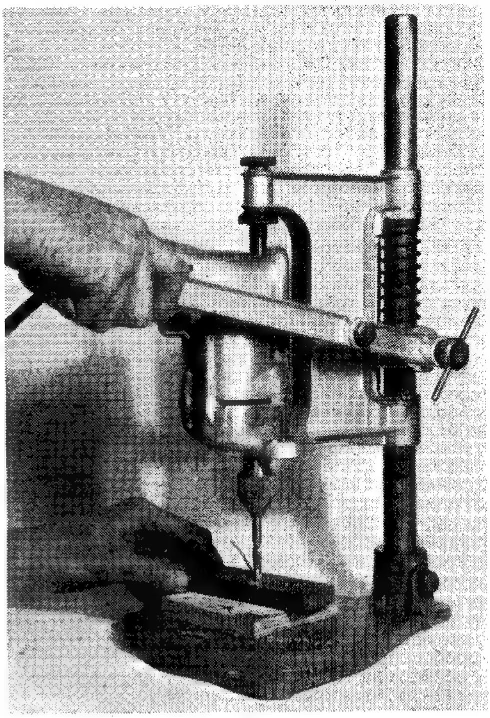
Drill gun mounted on horizontal stand

The basis of the tool, which incidentally comprises the power unit, is a light, but powerful electric drill gun, which takes drills up to ¼ in. diameter, and is geared to give a spindle speed of 2,250 r.p.m., is available in standard ratings for 110, 220 or 240 V, a.c. or d.c., and can be obtained as [redacted] separate unit if desired. The complete electric drill kit, which is supplied in a steel box, includes [redacted] set of 13 high-speed drills, from $\frac{1}{16}$ in. to ¼ in. inclusive, [redacted] grinding wheel 3 in.

diameter, one cotton buff 3 in. diameter, and [redacted] steel wire scratch brush 4 in. diameter, together with one wheel arbor, [redacted] tube of polishing compound, and a metal stand in which the electric power unit can be mounted horizontally so as to form [redacted] grinding and polishing head. The buffing and polishing outfit, [redacted] listed above, [redacted] also be obtained as [redacted] separate item.

A further accessory is the vertical stand, which converts the drill gun into [redacted] sensitive drilling machine, taking drills up to $\frac{1}{4}$ in. for use on wood or metal. It is however, capable of drilling holes up to $\frac{1}{2}$ in. diameter in soft metal or wood, by using special drills or boring bits with shanks reduced to fit the drill chuck. The attachment of the drill gun to either the vertical or horizontal stand is very simply and quickly effected by the manipulation of [redacted] single screw in each case, providing [redacted] positive and rigid three-point location.

In our tests on the tool, we found plenty of power available for drilling up to maximum capacity in steel, and the speed was suitable for grinding and buffing operations with the wheels supplied. Although the complete drill gun weighs only $3\frac{1}{4}$ lb., the power unit is robust and showed no sign of overloading on heavy work of several minutes' duration. As [redacted] hand tool, the drill gun is comfortable to hold and the trigger switch is conveniently placed ; it can be locked in the "on" position for continuous running. The price of the complete kit, or its separate components, has been kept within the reach of the amateur worker, whose activities, whether devoted to mechanical or domestic craftsmanship, will provide ample scope for the use of such a ubiquitous tool.



Mounted on a vertical stand

The drill gun in [redacted] [redacted] [redacted] hand drill

Rust—Its Prevention and Cure

by G. W. Arthur-Brand

RUST, largely [redacted] hydrated oxide of iron, is caused, basically, by the action of moist air [redacted] iron and steel, and is accelerated by the presence of atmospheric impurities. Model engineers [redacted] not without their problems in combating this menace, and it is with [redacted] view to helping readers that I present these few notes together with [redacted] review of some of the preparations which will be found satisfactory [redacted] additional [redacted] to prevention and cure.

Let us, then, revert to my opening sentence and endeavour to further clarify the cause and effect.

Moist air may present itself [redacted] the outcome of [redacted] number of causes, but the one with which we will concern ourselves here is the damp atmosphere too often prevalent in a large majority of unheated workshops. It is amazing how many home craftsmen suffer from the corrosion bug, and even more amazing how few apply their otherwise analytic minds to the problems of overcoming the cause.

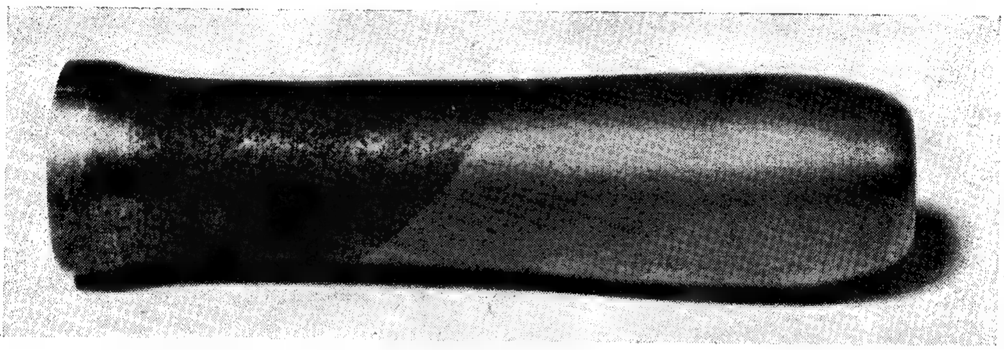
The first essential is temperature. Most model engineers are, quite naturally, allergic to cold when pursuing their craft and so, it is reasonable to assume that the average workshop is heated [redacted] least during its periods of occupation. But this is not enough! It is of great import that the room be maintained at a *constant* temperature throughout each twenty-four hours. This may be accomplished by the use of [redacted] small, single-bar ½ kW electric fire, suitably protected. The writer is against the [redacted] of paraffin stoves, the fumes of which [redacted] likely as not [redacted] cause more damage than the damp atmosphere. There are, however, [redacted] number of "blue-flame" stoves, quite well shielded, small and economical to operate which, always provided they [redacted] functioning correctly, [redacted] be relied upon to provide fumeless warmth. The important point is to keep the workshop [redacted] temperature and free from damp and fumes; to this end, don't forget to pay careful attention to adequate ventilation; and if the "blue-flame" is used, see that a chimney is fitted!

It will not be necessary to over emphasise the additional importance of ensuring that [redacted] damp rags are left lying around, [redacted] these will readily give off [redacted] moist vapour when warmed. See, too, that after machining operations, all traces of cutting fluids [redacted] removed from machines and machined components.

Now let us suppose that you have been [redacted] trifle late in applying the above precautions, and, [redacted] a result, you have in your possession [redacted] number of parts which already show signs of rust; what then?

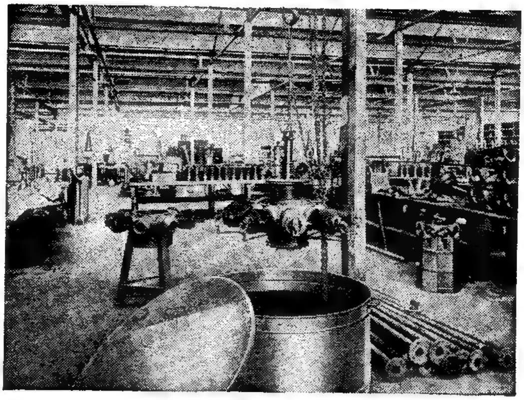
There are on the market, happily, a number of preparations which will come to your aid here, and one in particular, besides being thoroughly tested in the "M.E." Workshop, has been voluntarily recommended by [redacted] number of readers. I refer to "Jenolite," supplied by Jenolite Ltd., 43, Piazza Chambers, Covent Garden, London, W.C.2., a colourless liquid which completely removes rust without strong and harmful corrosive action. It requires no special apparatus for its use, the articles to be treated being simply dipped in the solution or, in the [redacted] of larger articles, it may be applied with [redacted] soft brush. It has [redacted] neutralising effect on the surface treated which delays re-rusting for [redacted] considerable period, and the resultant finish is possessive of exceptional bonding properties which ensure perfect adhesion of paints, cellulose and enamel. Further information and instructions for [redacted] may be obtained from the manufacturers.

There are [redacted] number of proverbs which could be applied to the question at hand, but for the sake of economy it might not be a bad idea to pay heed to the two which remind [redacted] that "a stitch in time [redacted] nine" and "prevention is better than cure."



A crank handle which has been partly immersed in "Jenolite" for ten minutes

To this end I would recommend Sozol, [redacted] preparation which deposits [redacted] thin, tenacious, transparent film, which penetrates to the innermost interstices, rendering the surfaces treated proof against oxidation and corrosion. The film progressively hardens after its initial drying until it reaches [redacted] tough, elastic stage, where parts so coated may be handled at normal temperatures without disturbance of the film.



Dipping an aircraft engine in "Sozol" rust preventative, back [redacted] the early twenties

Sozol is supplied in two principal grades. THIN for dipping and spraying, and THICK for brush application. It is obtainable, in tins from ½ gallon to 5 gallons, from Sozol (1924) Limited, 2, Copthall Buildings, Copthall Avenue, London, E.C.2.

For inhibiting internal combustion engines and other machinery, Shell Ensis Protectives are highly recommended, and their range covers [redacted] number of grades prepared to meet just about every demand. Space will not permit the necessary amount of reference to this subject here, but the manufacturers publish [redacted] handy little pocket guide (No. 11) which covers the subject fully and may be obtained [redacted] application from Shell Mex B.P. Ltd., 1, Kingsway, London, W.C.2.

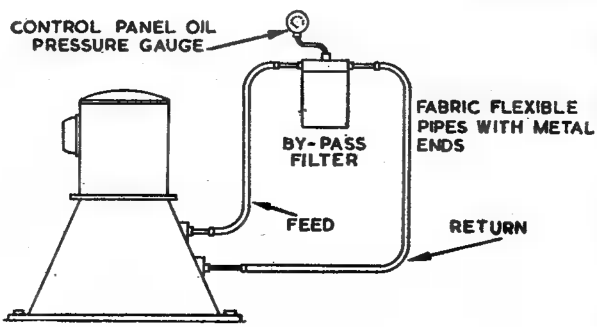
It would require a volume to cover fully a field [redacted] vast as the preservation of metals. Each part has its own problem to be met and there are, in fact, processes to meet them all.

An Oil-Feed Mystery

THE oil pressure gauge of [redacted] four-cylinder petrol engine, driving a power and lighting generator supplying an experimental workshop, [redacted] noticed one day to be registering 5 lb. p.s.i., instead of the usual 40 lb. p.s.i. As the engine showed no signs of distress, [redacted] risk was taken, and it was kept running until the end of the day.

The engine oiling system included [redacted] by-pass filter with a tap-off from the filter to the gauge, [redacted] per sketch. With the engine ticking over, [redacted] check on the gauge was made by disconnecting the feed pipe at the filter end. The oil issuing from the union end was obviously [redacted] no greater pressure than 5 lb. p.s.i. A choked gauze was suggested, and so the engine sump was dropped, the oil pump checked over, and the gauze cleaned. Some relief was felt when it was apparent that the main and big-end bearings were sound, and no bearing metal was found in the oil.

On reassembling and running up, [redacted] pressure of about 2 lb. p.s.i. [redacted] recorded, which, [redacted] the engine warmed up, rose to 5 lb. p.s.i. The oil relief-valve was checked, and found intact. Next, [redacted] pressure gauge was obtained, and coupled direct to the engine. Running up gave the full pressure of 40 lb. p.s.i. [redacted] the test gauge—obviously a choked feed pipe to the by-pass filter.



The pipe was removed, and blown through on an air line, refitted, and the engine run up again—still only 5 lb. p.s.i. on the control panel gauge. The newly-fitted oil feed pipe was once more disconnected from the filter end, and once more the oil just seeped out with the engine running light. The feed pipe was again removed, and blown through [redacted] the air line, but this time the air line was connected to the engine union end. Practically no air passed through the flexible pipe, yet blowing from the filter union end, a full body of air was passed. This fact was the clue to the mystery. The lining of the flexible pipe had failed at some point, and [redacted] acting, more [redacted] less, like a flap-valve, virtually cutting off oil flow from engine to filter, yet allowing test air to pass easily in the other direction.

A new flexible oil pipe was obtained and fitted, and [redacted] again full pressure was recorded.

The apparent anomaly of the gauge recording only 2 lb. p.s.i. after cleaning the sump gauze, and filling with new oil, was afterwards explained by the fact that the increased delivery pressure of the pump, had produced even greater constriction of the faulty flexible delivery pipe.—F.R.S.

Queries and Replies

Enquiries from readers, either on technical matters connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by stamped, addressed envelope, and addressed: "Queries Dept." THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases the letters may be published, inviting the assistance of other readers.

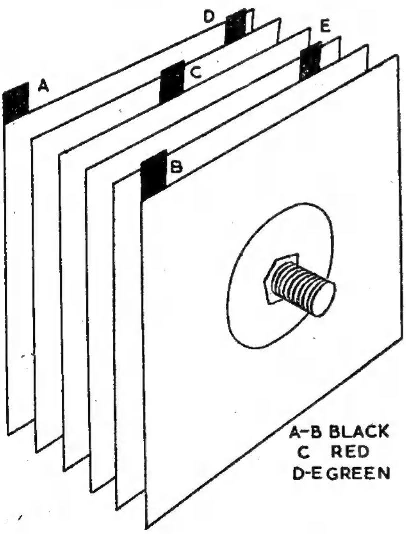
Where the technical information required involves the services of an outside specialist or consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered within the scope of this service.

No. 9872.—Rectifier Connections
L.B. (Co. Durham)

Q.—I have just purchased two 12-volt, 7 amp. rectifiers (sketch herewith) and shall be glad if you can give me the connections necessary for (a) 24 volt, 7 amp., and (b) 12 volt, 14 amp.

R.—Referring to your sketch, the lugs are connected as follows: *A* and *B* are connected together and form the d.c. negative pole, *C* is the d.c. positive pole. Lugs *D* and *E* are the a.c. terminals. Both rectifiers should be connected in this manner and then paralleled in the usual way. It must be pointed out, however, that many rectifiers are unsuitable for parallel connecting, and it would be advisable to approach the makers before carrying out any experiments on these lines.



No. 9863.—Electrified Fences
C.E.R. (Carlisle)

Q.—Would you please advise me how to build an electric fence of the type to prevent cattle or pigs from straying?

R.—We do not know the exact details of construction of the apparatus used in electrified fences, but they consist basically of some form of induction coil which produces a high voltage from a low-voltage battery. The coil is essentially a form of transformer and employs an interruptor device which, for this particular purpose, is designed to operate comparatively slowly, as compared with the interruptor on an ordinary induction coil. In the absence of an interruptor of the correct design, it would be possible to use a small electric motor with a reduction gear to make contact about ever half-second, or so. The simplest type of electric motor could be used, and the induction coil could be adapted from an ordinary motor-car ignition coil.

No. 9856.—Nuts and Bolts
A.W.T. (Southend-on-Sea)

Q.—I am constructing an aluminium greenhouse and I am told that if I use steel nuts and bolts, action will be set up and corrosion will take place. Would you kindly inform me if this is true, and, if so, what metal nuts and bolts I should use? It is considered that aluminium is not suitable for this purpose owing to the softness of the metal. If I use steel bolts, would paint prevent corrosion?

R.—The usual practice when using steel bolts for aluminium structures is to use bolts which are protected against corrosion by cadmium plating or some similar treatment. Paint or enamel might possibly be suitable for protecting the bolts, but it should be applied and thoroughly dried before they are inserted. Aluminium bolts and nuts are definitely too soft for use in structural work, but hard aluminium alloy, such as duralumin, is quite suitable for bolts, and is used extensively in aircraft construction.

No. 9860.—The Hipp Clock
R.H.S. (Wednesbury)

Q.—I am interested in building a Hipp clock, and would like you to explain the principle of this, and how the pendulum drives the clock. The book *Electric Clocks and How to Make Them*, published by Percival Marshall & Co. Ltd., does not appear to show where the pendulum-rod catches the mechanism, so turning the hands. On page 15, Fig. 5, one backstop is apparently hanging in space, but presumably it is fixed on to the baseplate or to the clock frame. No dimensions are given for front to back of clock.

R.—The Hipp electric clock works on the principle of using electric current to maintain the swing of the pendulum, which is thus used as a motor to drive the mechanism of the clock through a ratchet wheel and the usual gear train. The operation of the pendulum is as follows: an electro-magnet underneath the end of the pendulum-rod is arranged so that when energised, it attracts an armature in the form of an iron bar attached to the end of the pendulum-rod. The contact mechanism is arranged in such a way that when the pendulum is swinging over a certain arc, no contact whatever is made, and the electro-magnet is not energised, but when the swing of the pendulum dies down beyond a certain limit, the trigger on the pendulum-rod catches in the notch of the contact block, and presses down the contact spring for a very brief period, sufficient to give the pendulum an impulse and restore the full arc of swing. This process is repeated every time the pendulum tends to slow down.

It will be appreciated that the actual timing of the contact, so that the pendulum is accelerated and not retarded, is most important, and some delicacy of adjustment of the contact mechanism is necessary.

The ratchet mechanism which propels the wheel train is operated by the crutch pin which rests against the pendulum-rod, and is kept in contact with it by its weight, and that of the feed pawl. The pivot of the back-stop pawl is attached to the clock frame.

With regard to the dimensions from front to back, it should be quite easy to assess this when setting up the clock, as none of the dimensions are very critical.

PRACTICAL LETTERS

Rust Preventatives

DEAR SIR,—Referring to the recent correspondence on this subject and in particular "Physicist's" mention of "V.P.I.," I was at an exhibition during the summer called the "Made in Cheltenham" Exhibition.

On the stand of Messrs. Leonard Stace Ltd., of York Place, Swindon Road, Cheltenham, was a display showing the uses of "V.P.I." which was incorporated in coated wrapping papers made by them and developed by the Shell organisation.

They appeared to be advocating its use for the wrapping of small tools and engineering components, claiming that it is not necessary to have individual wraps for each article. It is held that moisture-proof sealing is then unnecessary, that the effect is to protect metal against condensation moisture within twelve inches of the material, that no greasing or lacquer coating is necessary. In their advertising, they offer to send samples and descriptive folder.

If these claims are upheld, "V.P.I." has wider applications than the wrapping of dry batteries and dry foodstuffs as suggested by "Physicist."

Yours faithfully,

Bristol 3. W. D. ARNOT.

Rust Prevention

DEAR SIR—I have noticed that the rusting of steel tools, etc. is still the subject of correspondence in your pages, and I have been rather surprised that a rust preventative, which has given me complete satisfaction over a great number of years, is not better known.

The rust preventative in question is simply ordinary beeswax and turpentine applied as a thin paste and polished with a soft cloth. Bright steel so treated may be handled with damp hands and left lying about for years without serious ill-effect.

I cannot think of a more suitable treatment for models, especially during construction when lacquering might be undesirable.

In my own workshop I always keep a small tin handy and all screws, whether going into wood or metal, get a preliminary dip.

Brasswork after treatment with metal polish may be given a final rub over with the beeswax, and although it will lose a little of its brightness it may be exposed to a town atmosphere for very long periods without becoming much tarnished.

During the war years my collection of antique pistols lay in a house which was unoccupied for two years and went nearly eight years without a clean. They had all been treated as suggested above and not one of them showed any sign of rust.

I have used beeswax for many years for rust-proofing my twelve-bore gun, and have never seen any sign of rust even after a full day in the rain.

A little resin added to the paste when mixing will give a higher polish if this is desired. When polishing, there is no need to make any distinction between brass, steel or wood.

It is best to use pure beeswax and pure turpentine (not substitute). Have a care when melting together, the mixture is highly inflammable. Spot on a cold saucer, as in jam making, to check consistency. Keep in closed tin. Apply thinly and polish until it no longer feels sticky.

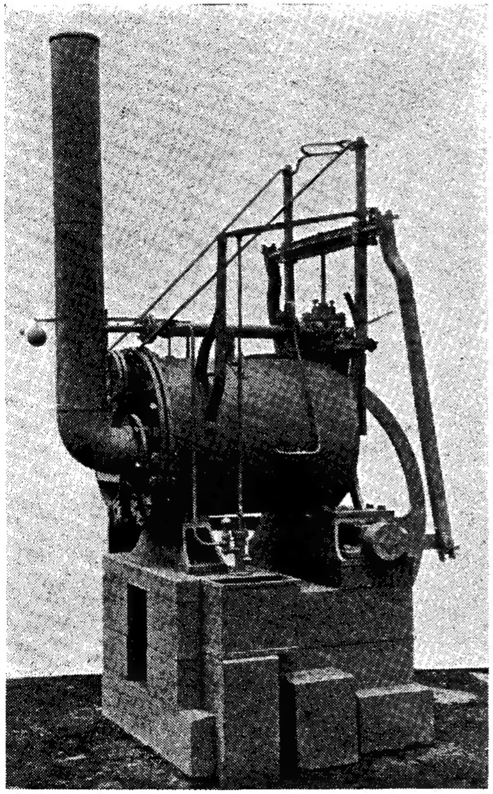
Yours faithfully,

South Shields. ERIC E. BARBER, M.B.E.

A Trevithick Engine

DEAR SIR,—I was very interested a while ago to read some letters on the subject of detachable firebox and flues from portable and semi-portable engines, in THE MODEL ENGINEER.

It occurred to me at the time, but I did not have the opportunity of being able to verify it, that this idea was very much older than anybody had thought. I was able, however, the other day to pay a visit to the Science museum at South Kensington, and verify what I thought was the fact; that is, that this arrangement of detachable firebox and flues is very old indeed. Actually, it was used by Trevithick certainly as early as 1805, probably as early as 1802.



Trevithick engine and boiler. (*By courtesy of the Director of the Science Museum, South Kensington*)

The photograph reproduced herewith shows the Trevithick engine and boiler in the Museum, with the firebox and return flue of one of his early engines, plus the whole end of the boiler, bolted to the main shell in a somewhat similar manner to that of the Robey engine you illustrated.

This engine is of particular interest, as it does show that the boiler shell itself is a very fine example of foundry work; it is made of cast-iron and the cylinder is cast integral with the boiler shell, which was a frequent practice of Trevithick with his engines. I believe many of these engines were made in the neighbourhood of Bridgnorth.

Yours faithfully,

Leighton Buzzard. A. L. JOHNSON.

Gear Cutting on the Shaper

DEAR SIR,—In your issue of September 14th, you have a description of gear cutting on a shaping machine, which is essentially the process of the "Bilgram" generating machine. This is incorrect in one very important feature, viz.: on page 403 are diagrams showing the gear generating disc, as the pitch circle, which is NOT the circle from which an involute gear is generated. It is from the base circle that the gear MUST BE generated. This circle is not the circle representing the bottom of the teeth, but quite independent of either pitch circle or bottom of teeth. As shown, it would not generate teeth which would be correct.

Yours faithfully,

Hove. JAMES PEARMAN.

DEAR SIR,—In reply to Mr. Pearman's letter dealing with my article on "Gear-cutting on the Shaper," I would first point out that no claim was made that the method was original. I merely suggested that such a method of gear-cutting did not appear to be generally known to your readers and that hand shapers were not generally used for this purpose.

The principle may be used on Bilgram machines: it is many years since I saw a machine of that type and I fear I have forgotten how it operates; but it certainly is used on some types of gear-grinders.

Mr. Pearman's statement that an involute form must be generated from the base circle is only true when the cutting tool is taken as a point; i.e. the tool would require to be cut away so that it would only cut on the corner, and this corner would have to be set in line with the tension wire which would be wrapped round a "base circle" disc. Such a method of gear generation is sometimes called the "describing generating process," presumably because the cutting point of the tool describes an involute curve.

The method described in the article, however, comes in the category of "mould generating" processes, which means that the tooth form is produced by a rack tooth—not a cutting point. The action is the same as if the teeth were rolled or moulded in the wheel, while in a plastic state, by rolling the wheel in contact with a rack.

The rolling action required is the same as that produced when a rack is engaged with a wheel of the same dimensions as that to be cut. It will be apparent that such a motion can only be produced by winding and unwinding the tension wire from a disc representing the *pitch diameter*, not the base circle diameter as Mr. Pearman suggests.

On the Maag gear grinding machine, the circular blocks, which give the rolling motion—flat steel bands taking the place of the steel wire in our cruder apparatus—are made to the pitch diameter and are indeed called "pitch blocks" by the Maag company.

Yours faithfully,

"BASE CIRCLE."

Safety Measures for Model Steam Engines

DEAR SIR,—It was with considerable interest I read S. W. Upjohn's letter in the August 3rd issue, on running steam engines and locomotives by means of bicarbonate of soda and tartaric acid, and water. This should be ideal for "O" and "1" gauge locomotives with small boilers, which do not allow the full height of a spirit flame.

Memories of my cycling and motor-cycling days, however, remind me that with acetylene gas-lamps having a drip feed, if too much gas was generated or the jet became blocked, the gas pressure rose, and blew back into the water reservoir, sometimes even blowing the water out of the filler cap.

The pressure could not have been much above atmospheric pressure, say 15 to 20 lb. per sq. in. Would this be high enough to work the average "1" gauge locomotive successfully? Mr. Upjohn's experiences would be enlightening, and I hope a complete answer to my questions.

Yours faithfully,

Leicester. F. C. GENT.

Modifications to 3½ in. Drummond Lathe

DEAR SIR,—Regarding the article on an apron for 3½ in. Drummond lathe, by H. Lloyd in THE MODEL ENGINEER, dated July 22nd and 29th, 1943.

Having a 3½-in. Drummond lathe with a ⅝ in. × 8 t.p.i. leadscrew and no rack and pinion or split-nut I decided to make an attempt at the above which was quite an effort due to shortage of material.

My first trouble came when having made split-nut slides, I noticed that the ⅞ in. dimension on the "T"-piece should have read $\frac{7}{16}$ in. Having remade "U"-piece and rectifying "T"-piece, I proceeded and made actuating plate for split-nut, and split-nut. I then assembled, only to find the ¼ in. symmetrical separation of split-nut was not enough to clear leadscrew.

So, I am pondering on redesigning split-nut slides and actuating plate or taking the necessary amount off threads when open the stated ¼ in. to clear leadscrew.

Yours faithfully,

Deal. T. R. FRANKS.

CLUB ANNOUNCEMENTS

The Oldham Society of Model Engineers

During the week of our recent successful exhibition over 3,000 visitors paid to view the show, despite the hall being a 2d. bus ride from the town centre! Models in action included a car track with electric- and diesel-driven cars running, three railway layouts (gauge "OO," "O" and "1") the steam tug, *Margaret*, in a water tank, a line of steam engines, and the exhibits of the radio control wallahs, so there was no shortage of movement. The Oldham Yacht Club had a number of yachts on show, and altogether we managed to present over 150 models without asking help from other clubs.

Future Friday night meetings are:—

November 10th. Lecture by Mr. C. W. Barnett (president).
November 24th. Lecture by Mr. H. Baron.
December 8th. Lecture by Mr. H. Griffiths.
December 22nd. Lecture by Mr. E. Foden.

All the above will be held in Room No. 3, King Street Co-operative Stores, Education Dept., at 8 p.m. Visitors very welcome.

Hon. Secretary: F. MILLER, 25, Eric Street, Oldham.

The Coventry Model Engineering Society

Meetings of the above society are being held fortnightly again at the B.T.H. Social Club, after the outdoor meetings at the Memorial Park. The programme for the remainder of the year is as follows:—

November 10th. "Films We Have Taken," by members.
November 24th. Annual dinner.
December 8th. Annual general meeting.

Hon. Secretary: W. J. DEAN, 52, Morris Avenue, Wyken, Coventry.

Lymington and District Model and Engineering Society

At a very successful monthly meeting of the above society, held at the workshops recently, we were pleased to welcome some new members enrolled as a result of the "Best So Far" exhibition held at the Community Centre, Lymington, this year.

During the exhibition we were pleased to receive visits from the modelmaking fraternity in the Isle of Wight, Somerset, Buckinghamshire, and Surrey, and even as far away as Yorkshire and Derbyshire. Four visitors came from Denmark, but we cannot claim they came only for our show!

Appreciation was recorded for the model societies at Totton, Southampton, Andover and Salisbury for their assistance in loaning models.

A proposal was made, and agreed to, that the society should build a model locomotive, trucks and track as a combined effort at the workshops. These models have always proved so popular with visitors at the exhibitions, and in the past we have hired one. This year we could not do this and the Southampton society kindly stepped in at very short notice and brought a track and locomotives to help us. We do appreciate the help we have had from fellow members of The Southern Federation of Model Engineers.

Hon. Secretary: T. CRABBE, "Hurst Cottage," Wainsford Road, Pennington, Lymington, Hants.

South London Model Engineering Society

We, and the Kent Model Engineering Society, are jointly holding a meeting at the Holbeach Road School, Catford Bridge, S.E.6, on Tuesday, November 14th, at 7.30 p.m.

The meeting will deal solely with the formula used in the recent locomotive trials and will endeavour to amend or improve it for future events.

A hearty invitation is extended to all locomotive men and clubs to attend this meeting. Their views and ideas will be most welcome.

Hon. Secretary: W. R. COOK, 103, Engleheart Road, Catford, S.E.6.

The West London Model Power Boat Club

The above club will hold their annual general meeting at the Leinster Hotel, Ossington Street, W.2, on Sunday, December 10th, at 11 a.m.

All members are requested to attend this important meeting.

Manchester Model Railway Society

Members of the above society are now working at full pressure to make the forthcoming annual exhibition worthy of the society's 25th birthday year. Seven working layouts will demonstrate the running of scales and gauges from 2½-in. to "OOO." The stationary exhibits will be grouped and displayed under a new system which will add greatly to their interest and visibility.

There are the usual cups and awards for members' work and competition appears to be keener than ever.

The Stephenson Locomotive Society, Birmingham Model Railway Club, Merseyside Model Railway Club, Derby Model Railway Club and Leeds Model Railway Club are being invited to participate.

The exhibition will be held at the Corn Exchange, Hanging Ditch, off Corporation Street, Manchester, on Friday, Saturday and Sunday, December 15th, 16th and 17th, 1950. The opening times are 11 a.m. each day and the closing times are 9 p.m. on 15th and 16th; 7 p.m. on 17th.

Hon. Secretary: T. MORRIS, 12, Rudyard Road, Knotty Ash, Liverpool, 14.